



TITLE:

# FLORA DESMIDIARUM JAPONICARUM IV

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## Flora Desmidiarum Japonicarum IV

Auctore

Minoru HIRANO

### Sect. **Cristatae** CEDERGREN emend. HIRANO

*Cosmarium* sect. *Cristatae* CEDERGREN in Ark. Bot. 25A: 4, 54, 1933 (pro parte)—  
*Cosmarium* subgen. *Cyclidium* TURNER in K. Sv. Vet. Akad. Handl. 25, 73, 1893 (pro parte)

Cellulae circulares vel subcirculares; semicellulae semicirculares, semi-ellipticae vel subovales, granulis vel verrucis regulariter vel irregulariter ordinatis.

- 1a. Cellulae cum marginibus integris ordinatae.
- 2a. Cellulae cum granulis in serie radiali in tota semicellula ordinatae ..... **C. intermedium**
- 2b. Cellulae cum serie marginibus denticulorum ordinatae..... **C. margispinatum**
- 2c. Cellulae cum verrucis in serie marginibus ordinatae.
  - 3a. Verrucae ambitu et intra marginem ordinatae, in centro verrucae ordinatae ..... **C. quadrifarium f. hexasticha**
  - 3b. Verrucae intra marginem ordinatae, in centro glabrae ..... **C. monomazum var. amazum**
- 1b. Cellulae cum crenis marginibus ordinatae.
  - 2a. Crenae profundae, crenis apicalibus et lateralibus inaequalibus; semicellulae cum tumore granulato mediano ordinatae ..... **C. caelatum**
  - 3a. Semicellulae semicirculares, granulis in serie radiali in totum intra marginem ordinatis ..... **f. typica**
  - 3b. Semicellulae angulari-semicirculares, granulis leviter in fascia supra sinum ordinatis ..... **var. spectabile**
  - 2b. Crenae vadosae, crenis apicalibus et lateralibus aequalibus; semicellulae sine tumore mediano.
    - 3a. Crenae apicales 2, crenae laterales 3, cellulae cum granulis duobus juxta supra isthmum ordinatae ..... **C. nasutum**
    - 3b. Crenae apicales 4, crenae laterales 4, cellulae sine granulis supra isthmum ..... **C. cyclicum**
    - 4a. Membrana glabra ..... **f. typica**
    - 4b. Membrana granulata in totam cellulam ..... **var. arcticum**

***Cosmarium intermedium*** DELP. in MIGULA Krypt. Fl. 2, 453, 1907; WFST Monogr. Brit. Desm. 3, 138, 1908.

Cellulae mediocres, circiter  $1\frac{1}{4}$ — $1\frac{1}{5}$  duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae semicirculares vel aliquantum pyramidato-semicirculares, angulis basalibus bene rotundis, apicibus late rotundis; membrana subtiliter granulata, granulis in seriebus concentricis ordinatis; a latere visae ovato-circulares; a vertice

visae ellipticae. Long. 64–82 $\mu$ , Lat. 53–64.5 $\mu$ , Lat. isth. 19.6–25.8 $\mu$ .

Hab. **Hokkaido**: Junsai-numa in Oshima. **Hondo**: Futatsumegata in Ugo; Togakushi-nenbutsu-ike in Shinano. **Kiushiu**: Kagami-ike, Nakahama of Lake Ikeda in Satsuma. (New to Asia) (Pl. XXVI, f. 3)

Distr. Europe, Canada.

**Cosmarium margispinatum** HIRANO in Act. Phytotax. Geobot. **14**, 35, 1950.

Cellulae modicae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae angulari-subsemicirculares, angulis basalibus rotundis, marginibus lateralibus paullo retuse 4–5 undulatis, apice convexo; membrana punctata et cum denticulis ambitu et intra marginem lateralem; a latere visae subcirculares, lateribus et apicibus cum denticulis utrobique ordinatis. Long. 58.8 $\mu$ , Lat. 53.2 $\mu$ , Lat. isth. 28 $\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (Pl. XXVI, f. 1)

Distr. Japan.

**Cosmarium quadrifarium** LUND. forma **hexasticha** (LUND.) NORDST. in BORGE Ark. Bot. **1**, 100, 1903; 1. c. **6**, 42, 1906; WEST Monogr. Brit. Desm. **3**, 143, 1908; STRÖM Naturw. Unters. Sarek. **3**, 479, 1923; OKADA Journ. Imp. Fish. Inst. **30**, 171, 1934; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. **2**, 84, 1934. — *Cosmarium hexastichum* LUND. in Nov. Act. Regn. Soc. Ups. **3**, VIII, 33, 1871. — *Cosmarium quadrifarium* LUND. in FUJISAWA Journ. Jap. Bot. **10**, 444, 1934.

Semicellulae in latere visae dispositae sunt in serie hexasticha cum verrucis emarginatis parallelis; in fronte visae series verrucarum sunt duo intra marginem, in centro semicellularum granuli 7 in seriebus duabus horizontalibus (3 supra et 4 infra) ordinatis. Long. 45–48 $\mu$ , Lat. 37–40 $\mu$ , Lat. isth. 16–18 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Benze-numa in Mutsu; Hosonuma, Koke-numa, Megata, Hirumo-numa, Mt. Komagatake, Mt. Kurikoma in Ugo; Mt. Azuma, Hakuryu-ko, Ôishita, Hijiori-naga-numa, Mt. Gassan, Mt. Sugigamine of Zawo in Uzen; Hibushi-numa, Ojroi in Iwaki; Nogiwano-kwannon-ike, Akai in Iwashiro; Oze, Ômine-numa, Mt. Akagi in Kôzuke; Kurosawano-ike, Takayachi on Mt. Myoko, Mt. Naeba, Kôridono-ike in Echigo; Tarobedaira, Mt. Tateyama in Etchû; Shigakôgen, Kirigamine, Happo-ridge, Tengunohara, Mt. Kazafuki, Ôhanami-ike, Karuisawa in Shinano; Takashihara, Kotsutsumi-nishi-ike in Mikawa; Tamaru, Ishigaki-ike, Jôdo-ike, Kanashôzu in Ise; Fuse-ike, Mt. Hira in Oomi; Takaraga-ike, Sawano-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Yabakei in Bunzen;

Imuta-ike in Satsuma; Koshiki-ike, Byakushi-ike, Ôhatayama of Mt. Kirishima in Hiuga. (Pl. XXVI, f. 2)

Distr. Japan. Kuriles, Java, Ceylon, Europe, Greenland, Australia, New Zealand.

I have not yet seen this typical species in our country but is recorded formerly by FUJISAWA from Yashima-ike of Mt. Kirigamine but his figure well corresponds to the forma *hexasticha*. This form is widely distributed in the *sphagnum* moor of the alpine and subalpine regions and in the marshes of lowland, but is rather rare and is confined to moor-bogs or dystrophic waters in western and southern Japan.

**Cosmarium monomazum** LUND. var. **amazum** RACIB. in Wydz. Akad. Um. Krakow 10, 16, 1889 (reprint).—var. *glabrum* HINODE in Hikobia 1, 149, 1952.

Var. *semicellulae* sine inflatione et *glabrae* ad medium; verrucis marginibus circa 16-20; a vertice visae hexagono-ellipticae, polis truncatis. Long. 30-31 $\mu$ , Lat. 30-31 $\mu$ , Lat. isth. 11 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Sarufutsu in Kitami; Tomakomai, Yûfutsu, Tôasa-numa, Benten-numa in Iburi; Shizukari in Oshima. (Pl. XXVI. f. 20, 21)

Distr. Japan, Poland.

**Cosmarium caelatum** RALFS in Brit. Desm. 103, 1848; MIGULA Krypt. Fl. 2, 468, 1907; WEST Monogr. Brit. Desm. 3, 134, 1908; KRIEGER Hedw. 70, 145, 1939; TAYLOR Pap. Mich. Acad. Sci. 19, 251, 1934; HIRANO Act. Phytotax. Geobot. 12, 84, 1943.

Cellulae submediocres, ellipticae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae subsemicirculares, marginibus valide crenatis, crenis lateralibus binis et ferne ulterius bicrenatis, 4 crenis lateralibus minoribus, apicibus 4-crenatis (minoribus quam in lateribus), crenis omnibus cum granulis duobus ad marginem (crenis inferioribus aliquando cum granulis tribus) et granulis 2 vel 3 in seriebus radiantibus (2-3) intra marginem et in centro granulorum sublevatis, supra isthmum tumore granulato, granulis in seriebus parum irregulariter verticalibus 6-7 ordinatis; a latere visae late ovato-pyramidatae, apicibus emarginatis cum angulis apicalibus rotundis; a vertice visae ellipticae, lateribus cum lato tumore in medio utrobique. Long. 45-50 $\mu$ , Lat. 39-45 $\mu$ , Lat. isth. 14-17 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Jiue-mon-ike in Kôzuke; Kurosawano-ike, Takayachi on Mt. Myôko in Echigo; Happô-ridge in Shinano. (Pl. XXVI, f. 6)

Distr. Japan, Europe, U. S. A., Azores.

var. **spectabile** (De NOT.) NORDST. in WEST Monogr. Brit. Desm. 3, 136, 1908; OKADA Journ. Imp. Fish. Inst. 30, 164, 1934; l. c. 33, 115, 1939; HIRANO Journ. Jap. Bot. 20, 45, 1944.

Var. apicibus minus crenatioribus, crenis apicalibus minoribus quam in lateribus. Long. 48–53 $\mu$ , Lat. 42–47.6 $\mu$ , Lat. isth. 14–16.8 $\mu$ .

Hab. **Hondo**: Mt. Komagatake in Ugo; Mt. Akagi in Kôzuke; Mt. Kirigamine, Daimon-pass in Shinano. **Kiushiu**: Bôgatsuru on Mt. Kujû in Bungo; Ô-hatayama of Mt. Kirishima in Hiuga. (Pl. XXVI, f. 7)

Distr. Japan, Europe.

Our form of *Cosmarium caelatum* do not exactly coincide with the WEST's description because of a possession of much crenated lateral margin (usually 3 crenae and lowermost one is sometimes further divided). Var. *spectabile* of this species is rather rarely distributed and is confined to the alpine regions. The variety is found often on the alpine moors and alpine pools and sometimes found on the cold spring of the mountains or even on the lowland.

**Cosmarium nasutum** NORDST. in MIGULA Krypt. Fl. 2, 472, 1907; WEST Monogr. Brit. Desm. 3, 259, 1908; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS. Pl. Crypt. 1, 43, 1933; OKADA Bot. Mag. 50, 83, 1936; HIRANO Jap. Journ. Bot. 14, 227, 1954.

Cellulae parvae, circiter 1½ longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae semicirculari-cuneatae, marginibus lateralibus 5-crenatis (cum crenis apicalibus et basalibus), apicibus 2 crenis et crenis aliquantum majoribus quam lateralibus, quae sunt minores, et per totum cum granulis duobus ad marginem, seriebus radiantibus 3–4 granulorum intra marginem, supra isthmum cum granulis duobus, glabris in centro semicellularum; a latere visae elongato-rectangulares cum apicibus truncatis, lateribus leviter inflationibus prope medium utrobique; a vertice visae ellipticae, lateribus cum inflatione in medio utrobique. Long. 35–42 $\mu$ , Lat. 28–36 $\mu$ , Lat. isth. 11–12.6 $\mu$ .

Hab. **Hokkaido**: Nopporo in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Hachimantai naga-numa in Rikuchû; Mt. Komagatake in Ugo; Hijiori-naga-numa, Kaibai-ike in Uzen; Kanazuka-mura, Kurosawano-ike on Mt. Myôko in Echigo; Mt. Eboshi-dake in Etchû; Shigakôgen, Daimon-pass, Togakushichûsha, Happo-ridge, Mt. Kazafuki, Kamikôchi, Ashinota-ike in Shinano. **Kiushiu**: Bôgatsuru on Mt. Kujû in Bungo; Ô-hatayama of Mt. Kirishima in Hiuga (Pl. XXVI, f. 19)

Distr. Japan, Corea, Europe, Spitzbergen, Greenland, Nova Zembla, U. S. A.

**Cosmarium cyclicum** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 35, 1871; JOHNSON Bull. Torrey Bot. Club 21, 287, 1894; WEST Monogr. Brit. Desm. 2. 145, 1905; MIGULA Krypt. Fl. 2, 440, 1907; SMITH Wisc. Bull. 57, 31, 1924.

Cellulae modicae, paene circulares, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari in vertice subampliato et exterius acutangulo apertoque; semicellulae semicirculares, angulis basalibus leviter rotundis, marginibus lateralibus regulariter et aequaliter crenatis, crenis circa 12 in toto ambitu marginis et seriebus duabus concentricis crenarum similarum intra marginem, centro glabro; a latere visae obverse cuneatae cum apicibus rotundato-truncatis; a vertice visae angusto-fusiformi-ellipticae. Long.  $52\mu$ , Lat.  $53\mu$ , Lat. isth.  $19.6\mu$ .

Hab. **Kiushiu**: Kôga-muta of Aso in Higo. (New to Asia) (Pl. XXVI, f. 9)

Distr. Europe, Greenland, Spitzbergen, Nova Zembla, U. S. A.

var. **arcticum** NORDST. in WEST Monogr. Brit. Desm. 2. 146, 1905; BÖRGESSEN Meddel. Grönl. 43, 79, 1910; STRÖM Naturw. Unters. Sarek. 3, 473, 1923; SKUJA Act. Horti Bot. Univ. Latv. 3, 153, 1928; OKADA Journ. Imp. Fish. Inst. 30, 165, 1934; INSAM & KRIEGER Hedw. 76, 99, 1937; WHELDEN Nat. Mus. Canad. Bull. 97, 77, 1947.

Cellulae subcirculares vel parum sexangulari-circulares; semicellulae in margine crenatae, crenis circa 12 in toto ambitu marginis, crenis apicalibus 4 et crenis lateralibus 4 utrobique, intra marginem bigranulatis, granulis in serie radialibus et concentricis ornatis. Long.  $47.3-51.6\mu$ , Lat.  $53.7-54\mu$ , Lat. isth.  $19.4-25.8\mu$ .

Hab. **Hondo**: Spring on Mt. Kanpu in Ugo. (New to Asia) (Pl. XXVI, f. 10)

Distr. Northern Kuriles, Europe, Spitzbergen, Greenland, Nova Zembla, N. America.

#### Sect. **Ornatae** HIRANO, sect. nov.

Semicellulae circulares, ellipticae vel reniformes, granulis vel verrucis regulariter vel irregulariter ordinatis.

1a. Semicellulae distincte ellipticae.

2a. Granula in serie regulari ordinata.

3a. Sinu aperto in extremo rotundo, isthmo elongato ..... **C. Portianum**

4a. Semicellulae exacte ellipticae,  $30-40\mu$  in longitudinem ..... f. **typica**

4b. Semicellulae subreniformes,  $25-31\mu$  in longitudinem ..... var. **nephroideum**

3b. Sinu angusto-lineari, isthmo non elongato ..... **C. Logiense** f. **expansa**

2b. Granula leviter in serie irregulariter ordinata.

3a. Granula non differentiat.

4a. Granula in serie irregulariter horizontali ordinata .... **C. sphalerostichum**

4b. Granula in serie radiali ordinata, granulis centralibus leviter separatis

..... **C. varsoviense**

- 3b. Granula centralia differentiata a granulis perimetrisis ..... **C. geminatum**
- 1b. Semicellulae subellipticae.
  - 2a. Semicellulae oblongo-ellipticae; cellulae circiter tam longae quam latae.
    - 3a. Cellulae minutae, sinu excavato et elliptico, marginibus lateralibus leviter productis et directis sursum versus ..... **C. novae-semillae** var. **sibericum**
    - 3b. Cellulae modicae, sinu lineari-aperto, marginibus lateralibus non productis ..... **C. trachydermum**
  - 2b. Cellulae  $1\frac{1}{3}$ — $1\frac{2}{3}$  plus longiores quam latiores.
    - 3a. Semicellulae subcirculari-obovatae, sinu angusto-lineari, granulis magnis in serie oblique ordinatis ..... **C. sphaeroideum**
    - 3b. Semicellulae subellipticae, sinu aperto in extremo rotundo, granulis minutis in serie transversali et verticali ordinatis ..... **C. Wittrockii**
- 1c. Semicellulae reniformes.
  - 2a. Apice non elevato, granulis non differentiatis.
    - 3a. Granula minuta.
      - 4a. Cellulae cum sinu lineari-aperto, granulis in serie horizontali et obliqua ordinatae ..... **C. perincisum**
      - 4b. Cellulae cum sinu angusto-lineari, granulis in serie radiali ordinatae ..... **C. Logiense**
    - 3b. Granula modica.
      - 4a. Cellulae modicae,  $45-30\mu$  in longitudinem, granulis in serie obliqua et leviter indistincte verticali ordinatis ..... **C. reniforme**
      - 5a. Semicellulae reniformes; apice convexo ..... f. **typica**
      - 5b. Semicellulae depresso-reniformes, apice recto ..... var. **compressum**
      - 5c. Semicellulae altiores, marginibus lateralibus inferioribus rectis et parallelis ..... var. **elevatum**
      - 4b. Cellulae magnae,  $110-120\mu$  in longitudinem, granulis in serie radiali ordinatis ..... **C. granulatum**
  - 2b. Apice elevato, granulis differentiatis ..... **C. ornatum**

**Cosmarium Portianum** ARCH. in MIGULA Krypt. Fl. 2, 448, 1907; WEST Monogr. Brit. Desm. 3, 165, 1908; BERNARD Dep. agr. Indes. Néerl. 110. 1908; SMITH Wisc. Bull. 57, 33, 1924; ALLORGE Rev. Alg. 5, 358, 1939; OKADA Inkwa. 167, 1939; TAFT Ohio Journ. Sci. 45, 198, 1945.

Cellulae submediocres,  $1\frac{1}{3}$  longiores quam latae, profunde constrictae, sinu aperto in vertice rotundo, isthmo leviter elongato; semicellulae ellipticae et granulatae, granulis rotundis in series verticales circiter 10–11 granulos vel leviter irregulariter ordinatis, granulis in ambitu toto marginis (17–21) in unaquaque semicellula, isthmis glabris et sine granulis; a latere visae granulato-circulares; a vertice visae granulato-ellipticae. Long.  $33-35\mu$ , Lat.  $25-27\mu$ , Lat. isth.  $10-11\mu$ .

Hab. **Hokkaido**: Tôro in Kushiro; Toyokoro in Tokachi; Horomui, Minenobu in Ishikari; Tomakomai, Tôasa-numa in Iburi; Ko-numa of Ô-numa park in Oshima. **Hondo**: Ôishita in Uzen; Akaiyachi in Iwashiro; Oze-numa, Ômine-numa in Kôzuke; Kanori-ike, Ô-hanami-ike, Kizaki in Shinano; Tanuki-numa in Suruga; Takashihara in Mikawa; Takaraga-ike

in Yamashiro. **Kiushiu**: Miyazaki in Hiuga. (Pl. XXVI, f. 23)

Distr. Japan, Kuriles, Siberia, China, India, Ceylon, Europe, Spitzbergen, Nova Zembla, N. America, Brazil, Australia, Azores.

var. **nephroideum** WITTR. in NORDSTEDT Vid. Med. Naturh. Foren 193. 1888; WEST Monogr. Brit. Desm. 3, 167, 1908; OKADA Journ. Imp. Fish. Inst. 30, 170, 1934; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Cellulae minores; semicellulae subreniformes vel semicirculari-ellipticae cum granulis minoribus. Long. 21-34 $\mu$ , Lat. 17-25 $\mu$ , Lat. isth. 8.4-11 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Nikuru-numa, Shimoyûbetsu in Kitami; Nakano near Sapporo in Ishikari; Yûfutsu in Iburi; Shizukari, Junsai-aka-numa in Oshima. **Hondo**: Nagatai in Mutsu; Mt. Komagatake in Ugo; Hakuryû-ko, Chûkawa-ike in Uzen; Akaiyachi, Nogiwano-kwannon-ike in Iwashiro; Ozegahara, Jiuemon-ike in Kôzuke; Lake Kizaki, Inago of Kitamaki-mura in Shinano; Mt. Hichimenzan in Kai; Tamaru, Jôdo-ike in Ise; Nukigawa, Matsubara-naiko, Fuse-ike in Oomi; Ariga-ike in Yamashiro. **Kiushiu**: Ahira in Ôsumi. (Pl. XXVI, f. 11)

Distr. Japan, Kuriles, China, Siberia, Europe, Iceland, N. America.

**Cosmarium Logiense** BISSET in WEST Journ. Bot. 38, 294, 1900; Monogr. Brit. Desm. 3, 163, 1908; TAYLOR Pap. Mich. Acad. Sci. 19, 256, 1934.

Cellulae modicae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae reniformes, angulis basalibus rotundis; a latere visae subcirculares; a vertice visae ellipticae; membrana minute granulata, granulis dense in serie subradialibus ordinatis; chromatophoris axialibus cum pyrenoidibus duabus ordinatis. Long. 58.8 $\mu$ , Lat. 53.2 $\mu$ , Lat. isth. 22.4 $\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Benten-numa in Iburi. (New to Asia) (Pl. XXVI, f. 17)

Distr. Europe, New Foundland, W. Indies.

forma **expansa** W. & G. S. WEST in Monogr. Brit. Desm. 4, 16, 1911; HIRANO Act. Phytotax. Geobot. 12, 160, 1943.

Forma apicibus semicellularum latioribus, marginibus lateralibus minus convergentibus, granulis densioribus et minoribus. Long. 64.4-67 $\mu$ , Lat. 50.4-53 $\mu$ , Lat. isth. 16.8-18 $\mu$ .

Hab. **Hondo**: Daimon-pass in Shinano; Mt. Hira in Oomi. **Kiushiu**: Kagami-ike in Satsuma. (Pl. XXVI, f. 18)

Distr. Japan, British Isles.

**Cosmarium sphalerostichum** NORDST. in Ofvers K. Sv. Vet. Akad. Förh. 29, 1876; MIGULA Krypt. Fl. 2, 460, 1907; WEST Monogr. Brit. Desm. 3, 176, 1908.



Cellulae parvae, circiter tam longae quam latae vel leviter longiores, profunde constrictae, sinu angusto-lineari; semicellulae oblongae vel trapeziformo-ellipticae, angulis basalibus et apicalibus rotundis, angulis apicalibus plus bene rotundioribus, apicibus rectis et leviter convexis; membrana aspere punctata, punctulis irregulariter dispositis sed aliquantum in serie horizontalibus circiter 3-4 dispositis; a latere visae circulares; a vertice visae ellipticae. Long. 16-24.5 $\mu$ , Lat. 14-21.5 $\mu$ , Lat. isth. 5-7 $\mu$ .

Hab. **Hondo**: Akaiyachi in Iwashiro; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Ikejiri-ike in Tanba. **Kiushiu**: Ô-hatayama of Mt. Kirishima in Hiuga. (New to Asia) (Pl. XXVII, f. 4, 29)

Distr. Europe, Greenland, U. S. A., Brazil.

**Cosmarium varsoviense** RACIB. in Pamietn. Wydz. Akad. Um. Krakow 17, 18, 1839. (reprint)

Cellulae mediocres, circiter 1½ duplo longiores quam latiores, profunde constrictae, sinu angusto in capite leviter dilatato, exterius acute aperto; semicellulae late ellipticae; membrana sparsim granulata, granulis parvis in seriebus radialibus intra marginem ornatis, in medio granulis magnis circa 6 leviter radialiter ornatis; a vertice visae ellipticae, lateribus cum granulis tribus in medio utrobique. Long. 36.4-42 $\mu$ , Lat. 30.8-33.6 $\mu$ , Lat. isth. 14-16.8 $\mu$ .

Hab. **Hondo**: Nogiwano-kwannon-ike in Iwashiro. (New to Asia) (Pl. XXVII, f. 8)

Distr. Poland.

**Cosmarium geminatum** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 31, 1871; ROY & BISSET Journ. Bot. 24, 195, 1886; WEST Monogr. Brit. Desm. 3, 177, 1908; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 12, 1942; HIRANO Journ. Jap. Bot. 20, 37, 1944.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu acutangulo aperto; semicellulae oblongo-subellipticae vel semicirculari-ellipticae, marginali dorso convexiore quam ventrali, angulis lateralibus rotundis, apicibus latis leviter convexis; membrana multo granulata, granulis in ambitu toto ad marginem et in seriebus duabus aequaliter radiantibus granulorum intra marginem ordinatis, granulis omnibus emarginato-dentato-formibus, in centro semicellularum cum tumore prominenti granulato, granulis quaternis ordinatis; a vertice visae oblongo-ellipticae, lateribus sinuato-dentatis, tumore prominenti emarginato-partibus duabus in medio utrobique, intra marginem lateralem utrumque cum seriebus duabus granulorum ordinatis. Long. 25-27 $\mu$ , Lat. 25-28 $\mu$ , Lat. isth. 7.8-8.4 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro in Tokachi; Horomui, Minenobu in Ishikari; Yûfutsu, Tôasa-numa, Tomakomai in Iburi; Shizukari,

Junsai-aka-numa in Oshima. **Hondo**: Komozuchi in Mutsu; Megata, Ogata in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike in Uzen; Kirifushi-numa, Izu-numa, Naga-numa in Rikuzen; Kôriyama, Hôzawa-ike, Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Nanko in Iwaki; Ômine-numa in Kôzuke; Goda-numa in Shimofusa; Ô-hanami-ike, Midoriga-ike on Mt. Yatsugatake in Shinano; Ô-numa in Mikawa; Toba, Jôdo-ike in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXVI, f. 22)

Distr. Japan, Europe, U. S. A., Brazil.

**Cosmarium novae-semillae** WILLE var. **sibericum** BOLDT in WEST Monogr. Brit. Desm. 3, 33, 1908; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 36, 1921; SKUJA Act. Horti Bot. Univ. Latv. 3, 162, 1928; PRESCOTT Pap. Mich. Acad. Sci. 23, 297, 1938.

Var. sinu semicellularum excavatoribus et isthmo angustioribus, denticulis prope marginem lateralem distinctioribus et denticulis intra marginem paucioribus; a vertice visae plus angusto-ellipticae. Long. 10-11 $\mu$ , Lat. 10-11 $\mu$ , Lat. isth. 5-6 $\mu$ .

Hab. **Hondo**: Akaiyachi in Iwashiro. (New to Asia) (Pl. XXVII, f. 18, 27)

Distr. Siberia, Europe, Canada.

**Cosmarium trachydermum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 64, 1835; Monogr. Brit. Desm. 3, 178, 1908.

Cellulae submediocres, circiter 1 $\frac{1}{4}$  longiores quam latae, profunde constrictae, sinu aperto acutangulo sed obtuso ad verticem; semicellulae elliptico-oblongae, lateribus bene rotundis, apicibus subtruncatis; a latere visae subcirculares; a vertice visae ellipticae; membrana granulata, granulis parvis in seriebus concentricis intra marginem; chromatophoris axialibus cum duobus pyrenoidibus in unoquoque semicellula. Long. 33.6-42 $\mu$ , Lat. 33.6-34 $\mu$ , Lat. isth. 13-17 $\mu$ .

Hab. **Hondo**: Biwa-ike in Owari. **Shikoku**: Yamada in Tosa. (New to Asia) (Pl. XXVII, f. 3)

Distr. British Isles, Madagascar.

**Cosmarium sphaeroideum** WEST in Monogr. Brit. Desm. 3, 178, 1908; HIRANO Bot. Mag. 66, 132, 1953.

Cellulae submediocres, circiter 1 $\frac{1}{2}$  duplo longiores quam latae, profunde constrictae, sinu angusto-lineari sed aliquando leviter lineari aperto; semicellulae transverse late ellipticae, marginibus lateralibus rotundis, apicibus leviter truncatis; a latere visae ellipticae; a vertice visae late ellipticae; membrana granulata, granulis magnis irregulariter dispositis circa 19-20 in toto ambitu marginis. Long. 56-60 $\mu$ , Lat. 32-34.4 $\mu$ , Lat. isth. 17 $\mu$ .

Hab. **Hondo**: Akaiyachi in Iwashiro; Kurobe-Jii-daira in Etchû. (Pl. XXVI, f. 4, Pl. XXVII, f. 2)

Distr. Japan, Germany, British Isles.

**Cosmarium Wittrockii** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 31, 1871; WEST Monogr. Brit. Desm. 3, 179, 1908; KRIEGER Ber. Dtsch. Bot. Ges. 56, 64, 1933.

Cellulae parvae, circiter  $1\frac{1}{3}$  longiores quam latae, profunde constrictae, sinu aperto subrectangulari, in vertice rotundato; semicellulae ellipticae, angulis lateralibus leviter obtuse rotundis; membrana granulata, granulis parvis in seriebus verticalibus et horizontalibus (circa 8-9 seriebus trans cellulam) ordinatis; a vertice visae ellipticae; a latere visae circulares. Long.  $21-22\mu$ , Lat.  $16\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hondo**: Chûkawa-ike in Uzen. (New to Japan) (Pl. XXVI, f. 14)

Distr. Siberia, Thailand, Europe, Nova Zembla.

**Cosmarium perincisum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 49, 31, 1921.

Cellulae mediocres, leviter longiores quam latae, profunde constrictae, sinu lineari aperto in capite rotundato, exterius lato; semicellulae subellipticae vel aliquantum reniformes, angulis basalibus bene rotundis, marginibus lateralibus leviter convergentibus, angulis apicalibus late rotundis, apicibus latis leviter convexis vel aliquando rectis; membrana granulata, granulis parvis in serie transversalibus et radialibus intra marginem; a latere visae circulares; a vertice visae oblongae, lateribus paene rectis. Long.  $56\mu$ , Lat.  $50.4\mu$ , Lat. isth.  $16.8\mu$ .

Hab. **Hondo**: Daimon-pass in Shinano. (New to Asia) (Pl. XXVI, f. 13, Pl. XXVII, f. 1)

Distr. N. Russia.

**Cosmarium reniforme** (RALFS) ARCH. in WEST Journ. Linn. Soc. Bot. 33, 307, 1898; MIGULA Krypt. Fl. 2, 454, 1907; WEST Monogr. Brit. Desm. 3, 157, 1908; SCHULZ Bot. Arch. 2, 134, 1922; SMITH Wisc. Bull. 57, 33, 1924; GISTL Krypt. Forsch. 1, 470, 1926; KRIEGER Arch. Hydrobiol. suppl. 11, 184, 1932; OKADA Journ. Imp. Fish. Inst. 30, 171, 1934; TAFT Ohio Journ. Sci. 45, 199, 1945; HIRANO Bot. Mag. 66, 133, 1953.

Cellulae mediocres, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae reniformes; a latere visae circulares; a vertice visae ellipticae; membrana granulata, granulis rotundis in seriebus obliquis et aliquando verticaliter ordinatis. Long.  $47-56\mu$ , Lat.  $43-47.6\mu$ , Lat. isth.  $17-22.4\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Mt. Hakkoda in Mutsu; Happô-ridge in Shinano; Lake Biwa in Oomi; Ikejiri-ike in Tanba. (Pl. XXVI, f. 5)

Distr. Japan, Manchuria, Siberia, Borneo, Europe, Greenland, Spitzbergen, N. & S. America.

var. **compressum** NORDST. in K. Sv. Vet. Akad. Handl. **22**, 46, 1838; WFST Journ. Linn. Soc. Bot. **33**, 307, 1898; Monogr. Brit. Desm. **3**, 158, 1908.

Semicellulae depressae, apicibus latoribus et truncatioribus; a vertice visae angustiores elliptico-oblongae. Long.  $56\mu$ , Lat.  $53\mu$ , Lat. isth.  $19.6\mu$ .

Hab. **Hondo**: Mt. Kirigamine, Daizahôshi-ike in Shinano. (New to Japan) (Pl. XXVI, f. 16)

Distr. India, Europe, U. S. A., British Guiana, New Zealand.

var. **elevatum** W. & G. S. WEST in Journ. Linn. Soc. Bot. **33**, 307, 1898; Monogr. Brit. Desm. **3**, 159, 1908; HIRANO Journ. Jap. Limnol. **16**, 18, 1952.

Var. cellulis  $1\frac{1}{2}$  duplo longioribus; semicellulis relative altioribus et angulis basalibus rotundato-subrectangularibus, partibus inferioribus semicellularum in margine paene parallelis. Long.  $53-62\mu$ , Lat.  $33-34\mu$ , Lat. isth.  $13-14.5\mu$ .

Hab. **Hokkaido**: Yûfutsu, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Koke-numa, Hirumo-numa, Moritake-ôtsutsumi in Ugo; Hizume in Rikuchû; Ôshitano-junsai-tsutsumi, Chûkawa-ike in Uzen; Naga-numa, Kirifushi-numa in Rikuzen; Kashima-cho in Iwaki; Akaiyachi, Nogiwanokwannon-ike in Iwashiro; Ozegahara in Kôzuke; Daimon-pass, Ashinota-ike in Shinano; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Kanashôzu in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizorogaike, Takaraga-ike in Yamashiro. **Kiushiu**: Ahira in Ôsumi. (Pl. XXVI, f. 15)

Distr. Japan, British Isles, N. America.

**Cosmarium granulatum** WEST in Monogr. Brit. Desm. **3**, 164, 1908.

Cellulae magnae, circiter  $1\frac{1}{3}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo ampliato; semicellulae reniformes, apice leviter recto; membrana granulata, granulis in serie radiali ordinatis; a latere et vertice visae ellipticae. Long.  $117-118\mu$ , Lat.  $86-87\mu$ , Lat. isth.  $30-31\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi. (New to Asia) (Pl. XXVI, f. 24, Pl. XXVII, f. 30)

Distr. Europe.

**Cosmarium ornatum** RALFS in Brit. Desm. 104, 1848; MIGULA Krypt. Fl. **2**, 453, 1907; WEST Monogr. Brit. Desm. **3**, 151, 1908; SCHULZ Bot. Arch. **2**, 132, 1922; SMITH Wisc. Bull. **57**, 34, 1924; INSAM & KRIEGER Hedw. **76**, 104, 1937; OKADA Journ. Imp. Fish. Inst. **33**, 116, 1939; HIRANO Act. Phytotax. Geobot. **12**, 97, 1943.

Cellulae submediocres, circiter tam longae quam latae vel leviter latiores, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae

reniformes vel depresso-ellipticae, marginibus lateralibus late et bene rotundis 5-8 granulis prominentibus praeditis, apicibus leviter elevatis et truncatis recte 5-7 granulis praeditis, infra apicem granulis similibus in serie horizontali praeditis, intra angulos laterales parvis granulis multis in serie obliqua quorum 4-5 directos ad isthmum praeditis, supra isthmum tumore granulato, granulis in seriebus verticalibus vel leviter subradialiter et irregulariter praeditis; a latere visae depresso-subcirculares; a vertice visae elliptico-oblongae, polis late rotundis, lateribus cum tumore granulato in medio utrobique, granulis semicellularum in seriebus verticalibus praeditis sed in centro glabris. Long. 32-39 $\mu$ , Lat. 36-41 $\mu$ , Lat. isth. 12-13 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Horomui in Ishikari; Tomakomai, Tôasa-numa, Yûfutsu in Iburi; Shizukari, Ko-numa in Oshima. **Hondo**: Nagatai, Kotsutsumi, Kyûtai in Mutsu; Nishi-numa, Megata, Ogata in Ugo; Ôishita, Chûkawa-ike in Uzen; Akaiyachi in Iwashiro; Oze-numa in Kôzuke; Hakkaku-ike in Kamifusa; Inago of Kitamaki-mura in Shinano; Tanuki-numa in Suruga; Ishigaki-ike in Ise; Shinohara-ike, Fuse-ike in Oomi. (Pl. XXVI, f. 8)

Distr. Japan, Kuriles, Siberia, Europe, Iceland, N. America, S. America.

#### Sect. **Margaritiferae** CEDERGREN emend. HIRANO

*Cosmarium* sect. *Margaritiferae* CEDERGREN in Ark. Bot. 25A: 4, 58, 1933 (pro parte) — sect. *Ptychodes* CEDERGREN in l. c. 25A: 4, 54, 1933 (pro parte) — subgen *Pyramidium* TURNER in K. Sv. Vet. Akad. Handl. 25, 73, 1893 (pro parte)

Cellulae hexagonales vel subhexagonales, profunde constrictae; semicellulae pyramidatae vel trapeziformes, granulis vel verrucis regulariter vel irregulariter ordinatis.

1a. Cellulae sine tumore centrali.

2a. Apice semicellularum non producto.

3a. Cellulae circiter tam longae quam latae vel 1½ longiores quam latiores; semicellulae subtrapeziformes.

4a. Margine cellularum integro; semicellulae subtrapeziformes.

5a. Cellulae sine granulis diversis in seriebus regularibus ordinatis.

6a. Cellulae in vertice visae ellipticae.

7a. Cellulae cum serie transversali granulorum, granulis rotundis.

8a. Cellulae cum granulis magnis ordinatae

..... **C. orthostichum** var. **pumilum**

8b. Cellulae cum granulis parvis ordinatae ..... **C. polonicum**

7b. Cellulae cum serie radiali granulorum ordinatae, granulis magnis et planis ..... **C. Sikhimense**

6b. Cellulae in vertice visae rhomboido-ellipticae cum paullo inflatione mediana ordinatae.

7a. Cellulae mediocriter magnae, 50-72 $\mu$  in longitudinem.

- 8a. Semicellulae subtrapeziformes, cellulae 68-72 $\mu$  in longitudinem ..... **C. Botrytis** var. **depressum**
- 8b. Semicellulae rhomboido-subtrapeziformes, cellulae 50-55 $\mu$  in longitudinem ..... **C. Raciborskii**
- 7b. Cellulae parvae, 34 37 $\mu$  in longitudinem ..... **C. punctulatum**
- 8a. Semicellulae oblongo-trapeziformes ..... f. **typica**
- 8b. Semicellulae subellipticae ..... var. **rotundatum**
- 5b. Cellulae cum granulis diversis ordinatae.
- 6a. Cellulae cum serie transversalibus granulorum ordinatae.
- 7a. Cellulae 38-40 $\mu$  in longitudinem, cum granulis 5 magnis in seriebus duobus horizontalibus ordinatae ..... **C. horomuiensis**
- 7b. Cellulae 32-33 $\mu$  in longitudinem, cum granulis duobus magnis ad centrum ordinatae ..... **C. orthostichum** var. **subpolonica**
- 7c. Cellulae 20-28 $\mu$  in longitudinem.
- 8a. Cellulae in vertice visae ellipticae.
- 9a. Cellulae cum granulis duobus magnis juxta supra isthmum ordinatae ..... **C. bipunctatum**
- 9b. Cellulae cum serie quaterna magnorum granulorum juxta infra apicem ordinatae ..... **C. pseudoquinarium**
- 8b. Cellulae in vertice visae rhomboido-ellipticae, cum granulis magnis ad medium utrobique ..... **C. vogesiacum**
- 6b. Cellulae cum serie radiali granulorum ordinatae, generaliter diversae ad series marginatas et centrales.
- 7a. Series centralium granulorum leviter in transverso et vertice ordinata ..... **C. punctulatum** var. **subpunctulatum**
- 7b. Series centralium granulorum in seriebus radialibus ordinata ..... **C. dichondrum**
- 8a. Series centralis non evidens; semicellulae ellipticae ..... f. **typica**
- 8b. Series centralis evidens; semicellulae trapeziformes ..... var. **subhexagonum**
- 6c. Cellulae cum granulis acutis marginibus vel spinis et serie centrali granulorum ordinatae ..... **C. trachypleurum**
- 7a. Spina marginalis brevis ..... var. **Nordstedtii**
- 7b. Spina marginalis longa ..... var. **cornutum**
- 4b. Margine cellularum undulato vel crenulato.
- 5a. Cellulae sine granulis diversis.
- 6a. Cellulae sine serie marginibus granulorum. .... **C. sexnotatum**
- 6b. Cellulae cum serie marginibus granulorum ordinatae ..... **C. furcatospermum**
- 7a. Cellulae 18-22 $\mu$  in longitudinem, granulis marginibus parvis .. f. **typica**
- 7b. Cellulae 32-34 $\mu$  in longitudinem, granulis crassis ..... var. **koreana**
- 5b. Cellulae cum granulis diversis; cum serie transversali 4 granulorum magnis juxta infra apicem semicellulae ..... **C. quinarium**
- 5c. Cellulae cum denticulis distincte ad angulos basales et apicales utrobique ordinatae ..... **C. otus**
- 3b. Cellulae circiter 1 $\frac{1}{2}$  longiores quam latiores; semicellulae truncato-pyramidatae.
- 4a. Margine cellularum integro, granulis in serie radiali ordinatae.
- 5a. Cellulae 90-120 $\mu$  in longitudinem; semicellulae ovato-pyramidatae ..... **C. tetraophthalmum**

- 5b. Cellulae 65-95 $\mu$  in longitudinem; semicellulae truncato-pyramidatae.
  - 6a. Cellulae in latere visae obovatae ..... **C. ochthodes**
  - 6b. Cellulae in latere visae late ellipticae ..... **C. Botrytis**
- 5c. Cellulae 50-60 $\mu$  in longitudinem ..... **C. margaritifera**
- 4b. Margine cellularum undulato; cellulae cum granulis duobus magnis juxta infra apicem ordinatae ..... **C. bigemma**
- 2b. Apice semicellularum producto.
  - 3a. Margine cellularum integro, granulis in serie radiali ordinatis ... **C. vexatum**
  - 3b. Margine cellularum undulato vel crenulato.
    - 4a. Cellulae cum granulis minutis in serie radiali ordinatis ..... **C. Sportella** var. **subundum**
    - 4b. Cellulae glabrae, sed cum granulis quaternis magnis juxta infra apicem ordinatis ..... **C. eductum**
- 1b. Cellulae cum tumore centrali ordinatae.
  - 2a. Cellulae circiter tam longae quam latae vel leviter longiores quam latiores.
    - 3a. Cellulae sine granulis diversis in dispositione, granulis centralibus leviter magnis ..... **C. Botrytis** var. **subtumidum**
  - 3b. Cellulae cum evidente serie marginali granulorum ordinatae.
    - 4a. Cellulae sine granulis ad marginem.
      - 5a. Cellulae cum tumore centrali glabro in unaquaque semicellula ..... **C. occultum**
    - 5b. Cellulae cum tumore centrali granulato in unaquaque semicellula.
      - 6a. Cellulae in latere visae circulares ..... **C. Blyttii**
        - 7a. Semicellulae cum papilla singula ad medium ..... f. **lithuanicum**
        - 7b. Semicellulae cum granulis 4 parvis ad medium tumoris ..... f. **typica**
      - 6b. Cellulae in latere visae ovatae.
        - 7a. Cellulae cum crenis 4-6 ad marginem lateris utrobique, crenis rotundis, inter crenas acutas ..... **C. subcrenatum**
        - 8a. Semicellulae cum serie verticali granulorum ad medium ordinatae ..... f. **typica**
        - 8b. Semicellulae cum serie arcuata granulorum ad medium ordinatae ..... var. **Nordstedtii**
      - 7b. Cellulae cum crenis tribus ad marginem lateris utrobique, crenis emarginatis, inter crenas cavae ..... **C. subprotumidum**
        - 8a. Crena lateralis emarginata, tumore granulato cum serie 3-4 verticali granulorum ordinato ..... f. **typica**
        - 8b. Crena lateralis bigranulata, tumore granulato reducto cum serie 3 granulorum ordinato ..... var. **Gregorii**
  - 4b. Cellulae cum granulis ad marginem ordinatae.
    - 5a. Anguli apicales cum evidentis denticulis ordinati, granulis centralibus in serie radiali ordinatis ..... **C. subalatum**
    - 5b. Anguli apicales sine denticulis, granulis centralibus in serie verticali ordinatis.
      - 6a. Crenae emarginatae, serie centrali granulorum evidentis et magnis ..... **C. subcostatum**
        - 7a. Cellulae 26-38 $\mu$  in longitudinem ..... f. **typica**
        - 7b. Cellulae 19-24 $\mu$  in longitudinem ..... f. **minor**
      - 6b. Crenae minute bigranulatae, serie centrali granulorum parvis ..... **C. formosulum**

- 7a. Margine laterali inferiori crenato, apice undulato ..... f. *typica*
- 7b. Margine laterali inferiori integro vel subcrenato, apice recto vel paullo retuso ..... var. *mesochondrium*
- 2b. Cellulae circiter  $1\frac{1}{2}$ — $1\frac{3}{4}$  plus longiores quam latiores.
- 3a. Margine cellularum integro.
  - 4a. Membrana ex toto granulata vel spinata.
  - 5a. Membrana ex toto cum serie radiali granulorum ordinata, apice angusto ..... *C. retusum* var. *angustatum*
  - 5b. Membrana cum serie marginibus denticulorum ordinata, apice lato ..... *C. Malinvernianum*
  - 4b. Membrana glabra in faciem sed granulata ad marginem ..... *C. paulense* var. *japonicum*
- 3b. Margine cellularum undulato vel crenato.
  - 4a. Cellulae sine serie marginibus granulorum ..... *C. binodulum*
  - 4b. Cellulae cum serie marginibus granulorum ordinatae.
  - 5a. Cellulae cum tumore mediano ordinatae.
    - 6a. Apice 5-6 crenato, granulato-tumore cum rigidis 6-8 granulis .. *C. binum*
    - 6b. Apice 4-crenato, granulato-tumore cum 5-6 serie verticali granulorum ordinato ..... *C. subspeciosum*
    - 7a. Crenis lateralibus 6, cellulae 40-50 $\mu$  in longitudinem ..... f. *typica*
    - 7b. Crenis lateralibus 8-9, cellulae 73-80 $\mu$  in longitudinem .. var. *validius*

**Cosmarium orthostichum** LUND. var. **pumilum** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 25, 1871; WEST Monogr. Brit. Desm. 3, 169, 1908; SCHULZ Bot. Arch. 2, 132, 1922; DICK Mitt. Pfälz. Nat. Ver. Pollichia 3, 130, 1930; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 13, 1942.

Var. cellulae minores quam in forma typica; semicellulae subelliptico-trapeziformes, granulis in seriebus 4 transversalibus et circa 8-9 verticalibus trans fronte semicellulae. Long. 25 $\mu$ , Lat. 22.4 $\mu$ , Lat. isth. 7 $\mu$ .

Hab. **Hondo**: Ôishitano-junsai-tsutsumi in Uzen (New to Asia) (Pl. XXVII, f. 7)

Distr. Europe, U. S. A.

**Cosmarium orthostichum** forma **subpolonica** MESSIK. in Viertelj. Naturf. Ges. Zurich. 74, 154, 1929.

Semicellulae aliquantum truncato-pyramidatae, sinu angusto-lineari non angusto aperto, granulis numerosioribus generaliter parvis sed granulis quaternis magnis in centro semicellularum ornatis. Long. 32.3 $\mu$ , Lat. 30 $\mu$ , Lat. isth. 8.6 $\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (New to Asia) (Pl. XXVI, f. 12)

Distr. Switzerland.

**Cosmarium polonicum** RACIB. in MIGULA Krypt. FL 2, 460, 1907; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 46, 1920; Mem. Soc. Faun. Flor. Fenn. 10, 268, 1934; BERGE Ark. Bot. 28A, 36, 1936; HIRANO Journ. Jap. Bot. 20, 48, 1944.



Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae subtrapeziformes, angulis basalibus bene rotundis, marginibus lateralibus convexis convergentibus, apicibus paene rectis vel leviter convexis cum angulis apicalibus obtuse rotundis; membrana granulata, granulis irregulariter dispositis. Long.  $20-28\mu$ , Lat.  $19-22.4\mu$ , Lat. isth.  $6-8.4\mu$ .

Hab. **Hokkaido**: Ko-numa in Oshima. **Hondo**: Komozuchi in Mutsu; Aka-numa in Ugo; Chûkawa-ike in Uzen; Kobuchi-numa, Naga-numa, Izu-numa in Rikuzen; Kôriyama, Kagami-ishi-mura in Iwashiro; Ômine-numa in Kôzuke; Ushiku-numa in Hitachi; Onjaga-ike in Kamifusa; Mt. Kirigamine, Inago of Kitamaki-mura, Lake Nakatsuna, Ashinota-ike in Shinano; Kotsutsumi-nishi-ike in Mikawa; Biwa-ike in Owari; Jôdo-ike in Ise; Shinohara-ike in Oomi. **Shikoku**: Yamada in Tosa. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Miyazaki in Hiuga. (Pl. XXVII, f. 5)  
Distr. Japan, Europe.

**Cosmarium Sikhimense** TURNER in K. Sv. Vet. Akad. Handl. 25, 61, 1893; HIRANO Journ. Jap. Bot. 20, 48, 1944.

Cellulae mediocres, circiter  $1\frac{1}{4}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae subtrapeziformes, angulis basalibus bene rotundis, apicibus angustis rectis vel leviter convexis, angulis apicalibus latissime rotundis; membrana granulata, granulis in seriebus concentricis radiatis in ambitu et intra marginem; a latere visae circulares. Long.  $35-47\mu$ , Lat.  $27-38.7\mu$ , Lat. isth.  $11-19\mu$ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Tôro in Kushiro; Nikuru-numa, Kucharo-ponto, Koetoi-konuma in Kitami; Toyokoro in Tokachi; Shiraoi-poroto-numa in Iburi. **Hondo**: Hirumo-numa, Futatsuyagata in Ugo; Kôriyama in Iwashiro; Ômine-numa, Mt. Akagi in Kôzuke; Kôrido :ono-ike in Echigo; Happô-ridge, Karuisawa, Ôhanami-ike, Lake Nakatsuna, Kizaki in Shinano; Biwa-ike in Owari; Tanuki-numa in Suruga; Jôdo-ike in Ise; Mizoroga-ike in Ya nashiro. **Shikoku**: Shiramizu-pass in Iyo. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi; Miyazaki in Hiuga. (Pl. XXVII, f. 11)

Distr. Japan, India.

Judging from the inaccurate figure and description given by TURNER, I have assigned our form to this species. The cell wall is always granulated, but the granules are small and radially disposed. In vertical view of semicell the median part of semicell does not show any tendency of inflation. This species is allied to the *Cosmarium punctulatum*, especially

var. *granulosculum* but is different from it by larger size of semicell and well granulated cell wall. This species is widely distributed in marshes and ponds.

**Cosmarium Botrytis** MENEGH. in ROY & BISSET Journ. Bot. **24**, 194, 1886; WEST Monogr. Brit. Desm. **4**, 1, 1911; SMITH Wisc. Bull. **57**, 33, 1924; OKADA Journ. Imp. Fish. Inst. **30**, 163, 1934; TAYLOR Pap. Mich. Acad. Sci. **19**, 251, 1934; INSAM & KRIEGER Hedw. **76**, 97, 1937; OKADA Inkwa. 169, 1939; TAFT Ohio Journ. Sci. **45**, 192, 1945.

Cellulae mediocres vel maiores, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter dilatato; semicellulae angulari-pyramidatae, angulis basalibus late rotundis, marginibus lateralibus convexis, apicibus angustis truncatis et rectis vel leviter convexis; membrana regulariter et aequaliter granulata, granulis parum in serie concentricis ad marginem, sed prope centrum irregularibus; a latere visae ellipticae; a vertice visae ellipticae. Long. 56-59 $\mu$ , Lat. 50-54 $\mu$ , Lat. isth. 14-18 $\mu$ .

Hab. **Kiushiu**: Ahira in Ôsumi. (Pl. XXVII, f. 13)

Distr. Japan, Kuriles, Manchuria, China, Siberia, Mongolia, Ceylon, Pamir, Asia Minor, Europe, Greenland, Spitzbergen, Nova Zembla, N. & S. America, New Zealand, S. Africa, Azores.

var. **depressum** W. & G. S. WEST in Monogr. Brit. Desm. **4**, 7, 1911.

Cellulae breviores, circiter 1 $\frac{1}{6}$  duplo longiores quam latiores; semicellulae depressae, angulis basalibus latissime rotundis, angulis apicalibus obtusis. Long. 67 $\mu$ , Lat. 56 $\mu$ , Lat. isth. 14 $\mu$ .

Hab. **Hondo**: Hôzawa-ike in Iwashiro. (New to Asia) (Pl. XXVII, f. 12)

Distr. British Isles.

var. **subtumidum** WITTR. in WEST Monogr. Brit. Desm. **4**, 4, 1911.

Cellulae latiores, granulis cum centrali tumore leviter maiores quam in ceteris. Long. 56 $\mu$ , Lat. 51 $\mu$ , Lat. isth. 14 $\mu$ .

Hab. **Hondo**: Rokujizo in Yamashiro. (New to Asia) (Pl. XXVII, f. 25)

Distr. Siberia, Europe, Greenland, Canada.

**Cosmarium Raciborskii** LAGERH. in JOHNSON Bull. Torrey Bot. Club **22**, 294, 1895; MIGUIA Krypt. Fl. **2**, 449, 1907; HOMFELD Pflanzenf. **12**, 53, 1929; SKUJA Act. Horti Bot. Univ. Latv. **4**, 64, 1929; INSAM & KRIEGER Hedw. **76**, 107, 1937.

Cellulae submediocres, circiter tam longae quam latae vel leviter latiores quam longiores, profunde constrictae, sinu angusto-lineari vel acuto aperto et extremo ampliato, extrorsum aperto; semicellulae rhomboido-subtrapeziformes, marginibus lateralibus inferioribus convexis et divergentibus, marginibus lateralibus superioribus convergentibus et rectis vel convexis, apice angusto-

recto vel convexo, marginibus lateralibus rotundis; a vertice visae angustorhomboidae; a latere visae circulares; membrana granulata, granulis in serie radiali ordinatis; chromatophoris cum pyrenoidibus duobus in unaquaque semicellula. Long. 42-49 $\mu$ , Lat. 50.4-56 $\mu$ , Lat. isth. 15.4-19.6 $\mu$ .

Hab. **Hokkaido**: Tomakomai, Shiraoi-poroto-numa in Iburi. (New to Asia) (Pl. XXVII, f. 28)

Distr. Europe, N. America.

**Cosmarium punctulatum** BRÉB. in ROY & BISSET Journ. Bot. 24, 195, 1886; MIGULA Krypt. Fl. 2, 457, 1907, WEST Monogr. Brit. Desm. 3, 206, 1908; ALLORGE Rev. Alg. 5, 359, 1930; INSAM & KRIEGER Hedw. 76, 106, 1937; HIRANO Journ. Jap. Bot. 20, 38, 1944.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato et exterius leviter aperto; semicellulae oblongo-trapeziformes vel late truncato-pyramidatae, angulis basalibus rotundis, marginibus lateralibus convexis convergentibus, apicibus late truncatis rectis vel leviter convexis cum angulis apicalibus rotundis; membrana minute et dense granulata, granulis in seriebus concentricis vel irregulariter verticalibus vel oblique instructis; a latere visae circulares; a vertice visae ellipticae, lateribus in medio utrobique cum paullo inflatione. Long. 23-41 $\mu$ , Lat. 21-35 $\mu$ , Lat. isth. 7-10 $\mu$ .

Hab. **Hokkaido**: Akan-junsai-numa, Kiritappu, Tokotan in Kushiro; Sarufutsu, Kutcharo-ponto, Wakkanai in Kitami; Minenobu, Horomui, Nopporo, Moere-numa, Nakano near Sapporo in Ishikari; Yûfutsu in Iburi; Ko-numa, Junsai-aka-numa in Oshima. **Hondo**: Akamizuzawa of Mt. Hakkoda, Kurobo-numa, Nagatai in Mutsu; Naga-numa of Mt. Hachimantai in Rikuchû; Hosonuma, Aka-numa, Megata in Ugo; Saigo-mura, Ôishita, Hijiori-naga-numa, Mazawano-naga-numa in Uzen; Kobuchi-numa in Rikuzen; Hôzawa-ike, Akai in Iwashiro; Umaushi-numa in Iwaki; Oze in Kôzuke; Goda-numa in Shimofusa; Gôno-ike, Kitaura in Hitachi; Mohara, Onjaga-ike in Kamifusa; Matsunoyama-ôike in Echigo; Tashihara-ike, Gakinotanbo, Sennin-ike in Etchû; Kanori-ike, Ashinota-ike, Kamikôchi, Shigakôgen, Happô-ridge, Mt. Kazafuki in Shinano; Tamaru, Ôkaguchi in Ise; Nukigawa, Matsubara-naiko, Fuse-ike in Oomi; Shakuhachi-ike, Rokujizo in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXVII, f. 15)

Distr. Kosmopolitan.

var. **rotundatum** KLEBS in WEST Monogr. Brit. Desm. 3, 211, 1908; HIRANO Bot. Mag. 66, 133, 1953.

Cellulae angulares, non pyramidatae ut in forma typica, apicibus leviter

convexis, granulis minutis uniformibus non variatis. Long. 43-47.3 $\mu$ , Lat. 30-34.4 $\mu$ , Lat. isth. 10.8 $\mu$ .

Hab. **Hondo**: Kurobishi on Happô-ridge in Shinano. (Pl. XXVII, f. 14)  
Distr. Japan, India, British Isles.

var. **subpunctulatum** (NORDST.) BÖRG. in WEST Monogr. Brit. Desm. 3, 209, 1908; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 74, 155, 1929; SKVORTZOW Phillip. Journ. Sci. 49, 151, 1932; INSAM & KRIEGER Hedw. 76, 106, 1937; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 23, 1953.

Var. tumoribus centralibus semicellularum nonnihil cum granulis inaequalibus ornatis, granulis centralibus 7 in serie concentrica vel seriebus duabus horizontalibus dispositis, infra apicem granulis 3-5 submagnis ornatis. Long. 28-34.4 $\mu$ , Lat. 28-30 $\mu$ , Lat. isth. 8.4-9.5 $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Kiritappu in Kushiro. **Hondo**: Benze-numa in Mutsu; Hizume in Rikuchû; Ôishita in Uzen; Izu-numa in Rikuzen; Kôriyama in Iwashiro; Lake Biwa, Shinohara-ike in Oomi. (Pl. XXVII, f. 10, 19)

Distr. Japan, Siberia, Europe, U. S. A., New Zealand, Brazil.

**Cosmarium horomuiensis** HIRANO in Act. Phytotax. Geobot. 14, 71, 1951.

Cellulae submediocres, circiter 1 $\frac{1}{4}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae trapeziformes, angulis basalibus obtusis, marginibus lateralibus convexis, apicibus rectis cum angulis apicalibus obtusis; membrana granulis ordinata, 5 granulis magnis in seriebus transversalibus infra apicem, seriebus superioribus duabus et seriebus inferioribus tribus granulis, granulis superioribus et inferioribus alternanter ordinatis, cum granulis parvis 5-6 ad marginem a basi ad apicem equidistanter ordinatis, cum serie scrobiculorum intra marginem lateralem utrobique et serie transversali 5 scrobiculorum supra isthmum, uno mediano leviter inferiori quam ceteris in dispositione ordinatis; a latere visae subcirculares, cum seriebus duabus verticalibus granulorum a basi ad apicem, lateribus granulis magnis duobus in parte superiori utrobique ordinatis. Long. 39 $\mu$ , Lat. 31 $\mu$ , Lat. isth 11 $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (Pl. XXVII, f. 16)

Distr. Japan.

**Cosmarium bipunctatum** BÖRGESSEN in WEST Monogr. Brit. Desm. 3, 213, 1908; TAFT Ohio Journ. Sci. 45, 192, 1945.

Cellulae subparvae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari; semicellulae trapeziformes, angulis basalibus et apicalibus obtusis, marginibus lateralibus convexis convergentibus, apicibus late

truncatis, marginibus undulato-crenatis, crenis apicalibus 6 cum angulis apicalibus et crenis 6 lateralibus utrobique cum angulis apicalibus et basalibus, seriebus duobus radialibus granulorum intra marginem, in centro granulis duobus prominentibus horizontaliter dispositis; a latere visae circulares, lateribus prope medio utrobique granulis singulis ornatis; a vertice visae oblongo-ellipticae, lateribus cum duobus granulis in medio utrobique. Long.  $18.2\mu$ , Lat.  $14\mu$ , Lat. isth.  $5.6\mu$ .

Hab. **Hondo**: Hibushi-numa in Iwaki. (New to Asia) (Pl. XXVIII, f. 11)  
Distr. Europe, U. S. A., Brazil.

**Cosmarium pseudoquinarium** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B. 19, 66, 1948.

Cellulae parvae, circiter  $1\frac{1}{2}$  plus longae quam latae, profunde constrictae, sinu angusto-lineari extremo subampliato; semicellulae late pyramidatae vel subsemicirculares, angulis basalibus rotundatis, angulis apicalibus late rotundatis, apicibus truncatis et rectis vel leviter convexis, intra apicem granulis magnis quaternis in linea horizontali ordinatis, marginibus lateralibus convexis et 5-6 granulis minoribus ordinatis; in centro seriebus binis horizontalibus granulorum minorum, 5-6 in serie utraque; a latere visae subsphaericae, apicibus leviter truncatis, in centro granulis minoribus in seriebus binis verticalibus et granulis paucis a basi ad apicem usque ordinatae, granulis majoribus singulis utrobique prope apices; a vertice visae ellipticae, intra marginem subconvexae, serie granulorum 6 ordinatae, granulis in centro majoribus et intra polum minoribus, in apicis centro glabrae. Long.  $25.2-28\mu$ , Lat.  $19.6-22.4\mu$ , Lat. isth.  $6.5-7\mu$ .

Hab. **Hondo**: Koke-numa in Ugo; Ozegahara in Kôzuke; Mizoroga-ike in Yamashiro. (Pl. XXVIII, f. 22, 23)

Distr. Japan.

**Cosmarium vogesiacum** LEMAIRE in MIGULA Krypt. Fl. 2, 466, 1907; MESSIKOMMER Viertelj. Naturf. Ges. Zurich, 80, 52, 1935; HIRANO Act. Phytotax. Geobot. 12, 161, 1943.

Cellulae minutae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter dilatato et externe aperto; semicellulae elliptico-pyramidatae, angulis basalibus rotundis, marginibus lateralibus convexis convergentibus, angulis apicalibus late rotundis, apicibus late truncatis, rectis vel leviter convexis; membrana granulata, cum granulis parvis quorum duo majores in medio et dispositis in circa series tres horizontales transverse semicellulae et granulis circa 12-14 in ambitu toto marginis ordinatis; a latere visae semicellulae sunt circulares, cum uno granulo in medio utrobique; a vertice visae ellipticae, et a latere cum granulis duobus in medio

utrobique et polis leviter acute rotundis. Long. 15.4–16.8 $\mu$ , Lat. 15.4–16 $\mu$ , Lat. isth. 6.4–7 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Hachimantai in Mutsu; Mt. Kurikoma in Ugo; Ojiroi in Iwaki; Ozegahara in Kôzuke; Happô-ridge, Mt. Kirigamine in Shinano; Ishigaki-ike in Ise; Fuse-ike, Mt. Hira in Oomi. (Pl. XXVII, f. 26)

Distr. Japan, Europe.

I am not certain whether this species is a true *Cosmarium vogesiacum* or is an other species since I have not seen the LEMAIRE's original paper. According to the MESSIKOMMER's figures on the Viertelj. Naturf. Ges. Zurich Vol. 80, pl. 4, f. 54 and pl. 5, f. 56 the semicell is elliptic-pyramidate in form and the granules are disposed in somewhat irregularly two radial series within around the margin, while in our forms the granules are disposed in a somewhat transverse series across the face of the semicell, about three series are visible, and two large granules are at the centre. Another noteworthy species is *Cosmarium bipunctatum* that is trapezoid semicell. This species has a radial series of granules within the margin and two large granules at the centre of semicell. Both species are similar each other in disposition of granules and in having the central large granules, but the form of semicell is quite different. This species is not common in our country, and is found at the margin of marshes or peaty bogs of lowland and upland.

**Cosmarium dichondrum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 65, 1895; KRIEGER Arch. Hydrobiol. suppl. II, 175, 1932.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae elliptico-subtrapeziformes, angulis apicalibus et basalibus obtusis, apice truncato et recto; membrana minute granulata, granulis in serie radiali ordinatis, cum granulis duobus magnis prominentibus ad centrum juxta infra apicem; a latere visae circulares, lateribus cum prominentibus granulis prope apicem utrobique; a vertice visae ellipticae, lateribus cum granulis duobus ad medium utrobique. Long. 19.6 $\mu$ , Lat. 18.2 $\mu$ , Lat. isth. 7 $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Japan) (Pl. XXVII, f. 20)

Distr. Sumatra, Bali, Madagascar.

var. **subhexagonum** W. & G. S. WEST in Ann. Roy. Bot. Gard. Calcutta 6, 207, 1907.

Semicellulae late truncato-pyramidatae, marginibus lateralibus convexis convergentibus, angulis basalibus rotundis, angulis apicalibus obtusis, apicibus

truncatis rectis, granulis in serie radialibus in toto ambitu et intra marginem, in centro semicellularum granulis similibus circa 4-5 et granulis magnis duobus infra apicem ornatis. Long. et Lat.  $25\mu$ , Lat. isth.  $8.6\mu$ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (New to Japan) (Pl. XXVII, f. 21)

Distr. Burma.

**Cosmarium trachypleurum** LUND. var. **Nordstedtii** GUTW. in KRIEGER Arch. Hydrobiol. suppl. 11, 188, 1932.

Semicellulae pyramidato-semicirculares; a vertice visae rhomboides, inflatione mediana plus distinctae. Long.  $34.4\mu$ , Lat.  $25.8\mu$ , Lat. isth.  $10.8\mu$ .

Hab. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Japan) (Pl. XXVII, f. 6)

Distr. Java, Sumatra.

var. **cornutum** BERGE in Bih. K. Sv. Vet. Akad. Handl. III, 19, 29, 1894.

Var. semicellulae cum granulis centralibus parvis circa 6 in forma circulare ordinatae, spinis marginibus acutis et longioribus quam forma typica, spinis gradatim longis sursum apicem, spinis apicalibus superlongis. Long.  $47.6\mu$ , Lat.  $39.2\mu$ , Lat. isth.  $14\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (New to Asia) (Pl. XXVII, f. 9)

Distr. Europe.

**Cosmarium sexnotatum** GUTW. in WEST Monogr. Brit. Derm. 3, 227, 1908.

Cellulae parvae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari in capite leviter dilatato; semicellulae subcirculares, angulis basalibus subrectangularibus, marginibus lateralibus convexis leviter 4-crenatis, apicibus rectis, in centro semicellularum cum seriebus transversalibus 3 granulorum; a latere visae subcirculares; a vertice visae rhomboido-ellipticae, lateribus in medio utrobique cum 3-granulato-tumoribus. Long.  $32.3\mu$ , Lat.  $30\mu$ , Lat. isth.  $9.5\mu$ .

Hab. **Kiushiu**: Nakahara-ike of Fukiagenohama in Satsuma. (New to Asia) (Pl. XXVII, f. 23)

Distr. Europe.

**Cosmarium furcatospermum** W. & G. S. WEST in Monogr. Brit. Desm. 3, 206, 1908; DICK Mitt. Pfälz Ver. Nat. Pollichia n. f. 3, 127, 1930; SKVORTZOW Phillip. Journ. Sci. 49, 151, 1932; INSAM & KRIEGER Hedw. 76, 100, 1937; PRESCOTT Pap. Mich. Acad. Sci. 23, 206, 1938.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae truncato-semi-

circulares, marginibus crenatis, crenis lateralibus 4-5 (cum crenis basalibus), angulis basalibus rectangulari-rotundis, apicibus truncatis 4-crenatis; a latere visae paene circulares; a vertice visae ellipticae; membrana glabra, sed intra totum marginem seriebus radiantibus duobus granulorum, in centro supra isthmum granulis minutis duobus ordinata. Long. 19.6-29.4 $\mu$ , Lat. 18.2-25.2 $\mu$ , Lat. isth. 5.6-8.4 $\mu$ .

Hab. **Hondo**: Komotsuchi in Mutsu; Kawashiri, Nishi-numa in Ugo; Kobuchi-numa in Rikuzen; Kôriyama, Kagami-ishi-mura in Iwashiro; Onjaga-ike in Kamifusa; Higusa-numa in Shimofusa; Toba in Ise; Ariga-ike, Rokujizo in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamanouchi-mura in Sanuki; Shiramizu-pass near Matsuyama in Iyo. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Asia) (Pl. XXVIII, f. 10)

Distr. Europe, N. America.

var. **koreana** SKV. in Phillip. Journ. Sci. 49, 151, 1932.

Cellulae maiores, leviter longiores quam latae, granuli quoque maiores, robustiores. Long. 31-32 $\mu$ , Lat. 25-28 $\mu$ , Lat. isth. 8-11 $\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Tokotan in Kushiro; Sarufutsu in Kitami; Minenobu in Ishikari. **Hondo**: Kanori-ike, Inago of Kitamaki-mura in Shinano; Ariga-ike, Shakuhachi-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama, Morimatsu in Iyo. (New to Japan) (Pl. XXVIII, f. 7, 8)

Distr. Corea.

**Cosmarium quinarium** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 28, 1871; WEST Monogr. Brit. Derm. 3, 216, 1908; SMITH Wisc. Bull. 57, 36, 1924; DONAT pflanzenf. 5, 18, 1926; SKUJA Act. Horti Bot. Univ. Latv. 3, 170, 1928; TAYLOR Pap. Mich. Acad. Sci. 19, 264, 1934; OKADA Bot. Mag. 50, 253, 1936; HIRANO Act. Phytotax. Geobot. 12, 161, 1943.

Cellulae modicae, subhexagonales, circiter 1½ duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in apice aperto; semi-cellulae late pyramidato-truncatae, angulis basalibus rotundis, marginibus lateralibus leviter convexis, apicibus truncatis rectis cum angulis apicalibus rotundis, marginibus cum granulis parvis acutis 14-15 et infra apicem cum granulis magnis quaterna in serie horizontali ordinatis, intra angulos basales granulis minutis 2-3 et in centro granulis magnis 5 in seriebus duabus (2 subter et 3 supra), inter granulos magnos (5) puncta tria in formam triangulari ordinatis; a latere visae paene circulares, apicibus leviter truncatis, lateribus utrobique cum tribus granulis magnis et granulis parvis in seriebus duabus verticalibus a basi ad apicem, sed prope basim granulis quaternis ordinatis; a vertice visae ellipticae, granulis magnis quaternis



intra marginem lateralem utrobique ordinatis, in centro glabris. Long. 42-43 $\mu$ , Lat. 33-34 $\mu$ , Lat. isth. 11.5-12.7 $\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Kotsutsumi, Benze-numa in Mutsu; Koke-numa, Aka-numa, Moritake-ôtsutsumi, Megata, Mt. Kuri-koma in Ugo; Hizume in Rikuchû; Chûkawa-ike, Ôishita, Hijiori-naga-numa in Uzen; Kôriyama, Hôzawa-ike, Nogiwano-kwannon-ike, Akai in Iwashiro; Hibushi-numa in Iwaki; Ômine-numa, Ozegahara in Kôzuke; Kanazuka-mura, Kôridonono-ike in Echigo; Mt. Kirigamine, Shirouma-ôike in Shinano; Gakino-tanbo in Etchû; Kotsutsumi-nishi-ike, Takashihara in Mikawa; Ishigaki-ike, Jôdo-ike, Kanashôzu in Ise; Mt. Hira, Nukigawa in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXVII, f. 22)

Distr. Japan, Europe, N. America.

*Cosmarium quinarium* in our country is somewhat different from the European forms in the manner of arrangement of the larger granules. In European forms the large granules are disposed within the apical and lateral margins while in our forms four large granules are disposed in transverse serie just below the apex, and the marginal granules are distinctly smaller than that of the apical serie. Such forms are already recorded by G. M. SMITH from the lakes of Wisconsin in the United States. *Cosmarium quinarium* is distributed widely in the peaty bogs or marshes of the central and northern parts of Japan.

**Cosmarium otus** KRIEGER in Arch. Hydrobiol. suppl. 11, 181, 1932; HIRANO Act. Phytotax. Geobot. 14, 50, 1950.

Cellulae modicae, elliptico-hexagonales, circiter  $1\frac{1}{2}$  duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter dilatato; semicellulae truncato-pyramidatae, angulis basalibus obtusis, marginibus lateralibus convexis crenatis, crenis lateralibus circa 6-7 (cum angulis apicalibus et basalibus) utrobique, apicibus leviter convexis 4-crenatis (cum angulis apicalibus), crenis apicalibus leviter minoribus quam crenis lateralibus, angulis apicalibus granulis acutis parvis vel spinis brevibus exterius instructis; membrana in serie radiali verruci intra marginem totum instructa et plus quam ceteris punctata, punctulis sparsim sed in centro majoribus et distinctibus ornata. Long. 49.5 $\mu$ , Lat. 41 $\mu$ , Lat. isth. 10.8 $\mu$ .

Hab. **Hondo**: Shinohara-ike in Oomi. (Pl. XXVII, f. 17)

Distr. Japan, Sumatra.

**Cosmarium tetraophthalmum** BRÉB. in ROY & BISSET Journ. Bot. 24, 195, 1886; MIGUIA Krypt. Fl. 2, 452, 1907; WEST Monogr. Brit. Desm. 3, 270, 1908; OKADA Journ. Imp. Fish. Inst. 30, 172, 1934; TAYLOR Pap. Mich. Acad. Sci. 19, 269, 1934; INSAM & KRIEGER Hedw. 76, 109, 1937; MESSIKOMMER Hedw. 78, 185, 1938.

Cellulae magnae, circiter  $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu angusto-lineari ad verticem sed exterius acute aperto; semicellulae late ovatae vel pyramidato-ovatae, angulis basalibus late rotundis, apicibus leviter truncatis; membrana granulata, granulis magnis circa 12-14 in unoquoque latere, apicibus glabris, seriebus radiantibus et concentricis granulorum prope marginem, in medio reductis et irregularibus sparsimque ordinatis, inter granulos subtiliter punctatis; a latere visae subcirculares; a vertice visae ellipticae. Long.  $106-108\mu$ , Lat.  $64.4-69\mu$ , Lat. isth.  $17-25\mu$ .

Hab. **Hokkaido**: Yûfutsu, Tomakomai in Iburi. **Hondo**: Ogata in Ugo; Kashima-cho in Iwaki; Nogiwano-kwannon-ike in Iwashiro; Ô-hanami-ike in Shinano. (Pl. XXVII, f. 24)

Distr. Japan, Kuriles, Mongolia, China, Burma, India, whole Europe, Greenland, Spitzbergen, N. & S. America, New Zealand, Azores.

**Cosmarium ochthodes** NORDST. in Ofvers. K. Vet. Akad. Förh. 17, 1875; MUGULA Krypt. Fl. 2, 469, 1907; WEST Monogr. Brit. Desm. 4, 10, 1911; OKADA Journ. Imp. Fish. Inst. 30, 169, 1937; INSAM & KRIEGER Hedw. 76, 104, 1937; KRIEGER Ber. Dtsch. Bot. Ges. 56, 62, 1938; IRÉNÉE-MARIE Nat. Canad. 75, 156, 1945; TAFT Ohio Journ. Sci. 45, 198, 1945.

Cellulae submagnae, circiter  $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae semielliptico-pyramidatae vel ovato-pyramidatae, angulis basalibus leviter rotundis, marginibus lateralibus prope basim convexe divergentibus et subito convexo-convergentibus ad apicem, marginibus lateralibus distincte 7-granulato-crenatis (sine crenis apicalibus et basalibus), apicibus truncatis leviter 4-crenatis (cum crenis duobus apicalibus), granulis magnis in seriebus concentricis intra marginem, inflationibus in medio ordinatis; a latere visae ellipticae. Long.  $65-81\mu$ , Lat.  $48-56\mu$ , Lat. isth.  $14-25\mu$ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Tomakomai, Tôasa-numa in Iburi. **Hondo**: Bora-numa in Mutsu; Gôno-ike in Hitachi; Daizahôshi-ike, Kanori-ike in Shinano; Ikejiri-ike in Tanba. (New to Japan) (Pl. XXVIII, f. 1)

Distr. Kuriles, S. China, whole Europe, Nova Zembla, Greenland, Spitzbergen, N. America.

**Cosmarium margaritiferum** MENEGH. in RALFS Brit. Desm. 100, 1848; MUGULA Krypt. Fl. 2, 451, 1907; WEST Monogr. Brit. Desm. 3, 199, 1908; ALLORGE Rev. Alg. 5, 357, 1930; OKADA Journ. Imp. Fish. Inst. 30, 168, 1934; HIRANO Act. Phytotax. Geobot. 12, 93, 1943.

Cellulae mediocres, ellipticae, circiter  $1\frac{1}{2}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae truncato-pyramidatae, angulis basalibus late rotundis, marginibus lateralibus leviter convexis et margine granulato-undulatis ad apicem granulis reductis,

granulis circa 10-13 utrobique lateralibus, apicibus late truncatis rectis sine granulis cum angulis apicalibus late rotundis vel subobtusis rotundis; membrana granulata, granulis mediocriter magnis et regularibus in ambitu totius marginis sed non apicibus rectis, intra marginem granulis in seriebus subconcentricis et irregulariter in medio ordinatis, in medio semicellularum granulis minoribus irregularibusque et inter granulos scrobiculis minutis ordinatis; a latere visae ellipticae, granulis in seriebus verticalibus; a vertice visae elliptico-oblongae; centro glabro; chromatophoris axialibus cum duobus pyrenoidibus in unoquoque semicellula. Long.  $56-78\mu$ , Lat.  $48-59\mu$ , Lat. isth.  $17-26.6\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari; Ko-numa in Oshima. **Hondo**: Mt. Hakkoda, Kotsutsumi, Kyutai in Mutsu; Hosonuma, Megata, Hirumonuma in Ugo; Chūkawa-ike, Ôishita, Mazawano-naga-numa, Hakuryu-ko, Eboshi-numa in Uzen; Izu-numa, Kesho-numa in Rikuzen; Umaushi-numa, Hibushi-numa, Ojiroi, Kashima-cho in Iwaki; Akaiyachi, Nogiwano-kwannon-ike in Iwashiro; Ômine-numa, Mt. Akagi, Ozegahara in Kôzuke; Mt. Eboshi-dake in Etchu; Mt. Kirigamine, Happô-ridge, Ô-hanami-ike in Shinano; Kotsutsumi-nishi-ike, Takashihara in Mikawa; Ishigaki-ike, Kanashôzu, Tamaru in Ise; Shinohara-ike, Fuse-ike in Oomi; Takaraga-ike, Sawano-ike in Yamashiro. **Shikoku**: Matsuyama in Iyo; Yamada in Tosa. **Kiushiu**: Kagami-ike, Nakahama of Lake Ikeda, Imuta-ike in Satsuma; Ahira in Ôsumi; Ôhatayama of Mt. Kirishima in Hiuga. (Pl. XXVIII, f. 3)

Distr. Japan, Kuriles, Siberia, whole Europe, Iceland, Greenland, N. America, Brazil, New Zealand, Azores.

*Cosmarium margaritifera* in Japan is slightly larger than the WEST's dimension. This species is widely distributed on the swamps and *sphagnum*-bogs in our country and is sometimes found on the *sphagnum* moor of upland.

**Cosmarium bigemma** RACIB. in Pamietn. Wyd. Akad. Um. Krakow 17, 13, 1889. (reprint)

Cellulae submediocres, hexagono-ellipticae, profunde constrictae, sinu angusto-lineari in capite dilatato; semicellulae truncato-pyramidatae, angulis basalibus rotundis, marginibus lateralibus leviter convexis et delicate undulatis, apicibus truncatis et rectis, angulis apicalibus obtusis; membrana cum granulis duobus prominentibus juxta infra apicem; a vertice visae rhomboideae, lateribus granulis duobus in utrobique ordinatis; a latere visae obovatae, lateribus cum granulis ad angulos apicales utrobique. Long.  $36.4\mu$ , Lat.  $28\mu$ , Lat. isth.  $9.8\mu$ .

Hab. **Hokkaido**: Shimo-yûbetsu in Kitami; Nakano near Sapporo in Ishikari. (New to Asia) (Pl. XXVIII, f. 14)

Distr. Poland.

**Cosmarium vexatum** WEST in Monogr. Brit. Desm. 3, 187, 1908; SKVORTZOW Phillip. Journ. Sci. 49, 153, 1932; SKUJA Hedw. 77, 65, 1937.

Cellulae submediocres, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari extremo subampliato; semicellulae truncato-pyramidatae, angulis basalibus rotundis, angulis apicalibus obtusis, apicibus truncatis rectis, marginibus lateralibus leviter convexis; membrana granulata, granulis in seriebus radiantibus ad marginem, gradatim minoribus et irregulariter in medio reductis et ordinatis, in medio glabra; a latere visae subcirculares; a vertice visae oblongo-ellipticae, lateribus in medio utrobique cum tumore glabro ordinatis. Long.  $42\mu$ , Lat.  $35\mu$ , Lat. isth.  $11.5\mu$ .

Hab. **Hondo**: Izu-numa in Rikuzen; Matsubara-naiko in Oomi. (New to Japan) (Pl. XXVIII, f. 12)

Distr. Siberia, Asia Minor, Europe.

**Cosmarium sportella** BRÉB. var. **subnudum** W. & G. S. WEST in Monogr. Brit. Desm. 3, 186, 1908; TAYLOR Pap. Mich. Acad. Sci. 19, 266, 1934.

Cellulae longiores quam in forma typica; semicellulae pyramidatae, apicibus angustioribus et leviter retusis, angulis basalibus subrotundis; membrana minute granulata, sed non cum granulis centralibus prominentibus. Long.  $42\mu$ , Lat.  $33.6\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hondo**: Shakuhashi-ike in Yamashiro. (New to Asia) (Pl. XXVIII, f. 5)

Distr. Europe, New Foundland.

**Cosmarium eductum** ROY & BISSÉT in NORDSTEDT Vid. Medd. Nat. Foren. 193, 1888.

Cellulae submediocres, circiter  $1\frac{1}{2}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae subtrapeziformes, angulis basalibus obtusis, marginibus lateralibus convexis et leviter 3-undulatis in parte inferiore, marginibus lateralibus superioribus leviter retusis ad angulos apicales, apicibus truncatis et rectis cum angulis apicalibus rotundis; membrana granulis quaternis in serie transversalibus juxta infra apicem ordinata; a latere visae circulares, lateribus cum granulis ad apicem utrobique; a vertice visae ellipticae, lateribus cum granulis quaternis in serie duobus intra marginem ordinatis. Long.  $42\mu$ , Lat.  $31\mu$ , Lat. isth.  $8.4\mu$ .

Hab. **Hokkaido**: Tomakomai, Numanohata in Iburi. (New to Asia) (Pl. XXVIII, f. 16, 17)

Distr. Europe, Bornholm.

**Cosmarium occultum** SCHMIDLE in ENGL. Bot. Jahrb. 32, 69, 1902.

Cellulae parvae, leviter longae quam latae, profunde constrictae, sinu angusto-lineari; semicellulae truncato pyramidatae, marginibus lateralibus convexis et profunde 3-crenatis (cum angulis apicalibus et basalibus), marginibus lateralibus inferioribus minute 3-crenatis et leviter majoribus quam superioribus, angulis basalibus obtusis, angulis apicalibus rotundis, apicibus truncatis rectis, leviter 3-crenatis; membrana cum seriebus concentricis granulorum intra totum marginem, serie duobus granulorum ordinata, et glabra in ceterum; a vertice visae elliptico-oblongae, lateribus cum late inflatione ad medium utrobique; a latere visae ovatae, lateribus cum late inflatione utrobique. Long.  $22.4\mu$ , Lat.  $19.6\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Asia) (Pl. XXVIII, f. 15)

Distr. Central Africa.

**Cosmarium Blyttii** WILLE in MIGULA Krypt. Fl. 2, 475, 1907; WEST Monogr. Brit. Desm. 3, 225, 1908; HIRANO Act. Phytotax. Geobot. 12, 84, 1943.

Cellulae minutae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari; semicellulae trapeziformo-semicirculares, angulis basalibus subrectangulari-rotundis, marginibus lateralibus fere 4-crenatis (raro tricrenatis), apicibus truncatis 4-crenatis (cum angulis ambobus apicalibus), in ambitu toto granulis uni- vel binis ad marginem ordinatis, seriebus radiantibus granulorum minorum (1 vel 2 intra marginem), in centro supra isthmum granulis tribus vel quaternis majoribus quam in margine cum granulo vel cum una granulato-subpapilla magna; a latere visae circulares, cum granulis prominentis in medio utrobique; a vertice visae ellipticae cum granulis prominentibus medianis utrobique lateralibus; chromatophoris axialibus cum singulis pyrenoidibus ordinatis. Long.  $17-19\mu$ , Lat.  $14-16.8\mu$ , Lat. isth.  $4.2-5.6\mu$ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Tôroko in Kushiro; Shimo-yûbetsu, Nikuru-numa, Koetoi-konuma in Kitami; Toyokoro in Tokachi; Horomui in Ishikari; Yûfutsu in Iburi; Shizukari, Ko-numa, Junsai-numa in Oshima. **Hondo**: Naga-numa, Komozuchi in Mutsu; Hizume in Rikuchû; Moritake-ôtsutsumi, Nishi-numa, Megata in Ugo; Ôishita, Chûkawa-ike, Mazawano-naga-numa, Hakuryu-ko, Saigo-mura in Uzen; Izu-numa, Naga-numa, Kesho-numa, Kirifushi-numa in Rikuzen; Kôriyama, Akaiyachi in Iwashiro; Nanko, Umaushi-numa in Iwaki; Kanazuka-mura in Echigo; Oze-numa, Ômine-numa in Kôzuke; Kitaura, Gôno-ike in Hitachi; Onjaga-ike, Mohara in Kamifusa; Kanori-ike, Ôhanami-ike, Kizaki, Ashinota-ike, Inago of Kitamaki-mura in Shinano: Takashihara, Kotsutsumi-nishi-ike, Ô-

numa in Mikawa; Jôdo-ike in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXVIII, f. 29, 30)

Distr. Japan, Manchuria, Siberia, central China, Thailand, Ceylon, whole Europe, Greenland, N. America, Brazil, Africa, Madagascar, New Zealand.

*Cosmarium Blyttii* is widely distributed at the margin of bogs, swamps and small lakes in mountain regions, but is not found in the *sphagnum* moors of alpine and subalpine regions.

forma **lithuanica** RACIB. in Wydz. Akad. Um. Krakow **10**, 9, 1889. (reprint)

Semicellulae cum papilla in medio; membrana ceteris glabra. Long. et Lat.  $12.6\mu$ , Lat. isth.  $4.2\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (New to Asia) (Pl. XXVIII, f. 31)  
Distr. Poland.

**Cosmarium subcrenatum** HANTZSCH in NORDSTEDT Ofvers K. Vet. Akad. Förh. **21**, 1875; WEST Journ. Linn. Soc. Bot. **33**, 304, 1898; Ann. Roy. Bot. Gard. Calcutta. **6**, 207, 1907; Monogr. Brit. Desm. **3**, 228, 1908; DICK Krypt. Forsch. **1**, 450, 1926; TAYLOR Pap. Mich. Acad. Sci. **19**, 266, 1934; INSAM & KRIEGER Hedw. **76**, 109, 1937; MESSIKOMMER Hedw. **77**, 64, 1938.

Cellulae submediocres, leviter longiores quam latiores, profunde constrietae, sinu angusto-lineari in vertice subdilatato; semicellulae semicirculari-trapeziformes, marginibus lateralibus convexis crenatis, crenis 5 (cum angulis apicalibus et basalibus), apicibus truncatis et 4-crenatis, crenis omnibus cum duobus granulis minutis intra marginem, granulis in seriebus concentricis et radialibus circa 3 ordinatis, in centro semicellularum cum granulato-tumore, granulis in seriebus verticalibus circa 5 (seriebus granulorum 4-5); a latere visae ovatae, apicibus truncatis, lateribus in parte superiori retusis; a vertice visae ellipticae, lateribus utrobique cum tumore lato ordinatis. Long.  $22-34\mu$ , Lat.  $19.6-28\mu$ , Lat. isth.  $6.5-9\mu$ .

Hab. **Hokkaido**: Okineppe in Nemuro; Kiritappu in Kushiro. **Hondo**: Chûkawa-ike in Uzen; Gôno-ike in Hitachi; Hakkaku-ike in Kamifusa; Ashinota-ike in Shinano; Biwa-ike in Owari. (New to Japan) (Pl. XXVIII, f. 18)

Distr. Manchuria, Siberia, S. China, Burma, Sumatra, whole Europe, Iceland, Spitzbergen, Greenland, Franz Joseph Land, N. & S. America, Africa.

var. **Nordstedtii** SCHMIDLE in Ber. Dtsch. Bot. Ges. **11**, 551, 1893.

Var. crenis lateralibus 4, apice semicellularum truncato leviter retuso, non undulato vel crenato, semicellulis cum serie 4 granulorum intra marginem, cum granulato-tumore elliptico. Long.  $25\mu$ , Lat.  $22.4\mu$ , Lat. isth.  $5.6\mu$ .

Hab. **Hondo**: Hakkaku-ko in Kamifusa. (New to Asia) (Pl. XXVIII, f. 19)

Distr. Germany: *in litt.* (1938).

***Cosmarium subprotumidum*** NORDST. in Ofvers K. Vet. Akad. Förh. 38, 1876; MIGULA Krypt. Fl. 2, 470, 1937; WEST Monogr. Brit. Desm. 3, 231, 1908.

Cellulae submediocres, leviter longiores quam latiores, profunde constrietae, sinu angusto-lineari extremo leviter ampliato; semicellulae trapeziformo-subsemicirculares, parte tertia inferiori aequali in amplitudine, partibus aliis duabus superioribus valde attenuatis ad sursum, apicibus truncatis leviter 4-undulatis, angulis apicalibus obtusis et saepe oblique retusis, marginibus lateralibus cum crenis tribus, crena inferiores lata et retusa in medio, marginibus cum cavis tribus inter crenas duas superiores et inter angulos apicales; membrana cum serie granulorum radiantium intra totam marginem, granulis generatim duplicibus juxta et intra crenam unamquamque sed singulis prope centrum semicellularum, cum granulato-tumore in medio juxta et supra isthmum, granulis in seriis tribus verticalibus ordinatis, serie media recta et serie externa utraque arcum ad extrorsum formantes, omni serie in 4-5 granula composita; a latere visae semicellulae ovatae, lateribus cum tumore granulato magno ad basim utrobique et apice rotundato; a vertice visae ellipticae, lateribus cum distincte tribus crenulatis tumoribus ad medium utrobique. Long. 29-31 $\mu$ , Lat. 23.8-25.2 $\mu$ , Lat. isth. 6-8.4 $\mu$ .

Hab. **Hondo**: Kitaura in Hitachi; Higusa-numa in Shimofusa. (New to Japan) (Pl. XXVIII, f. 9)

Distr. Asia Minor, whole Europe, central Africa.

var. **Gregorii** (ROY & BISSET) W. & G. S. WEST in Monogr. Brit. Desm. 3, 232, 1908; KAISER Krypt. Forsch. 1, 226, 1919; KRIEGER Arch. Hydrobiol. suppl. 11, 187, 1932; SKVORTZOW Phillip. Journ. Sci. 49, 151, 1932.

Var. marginibus lateralibus semicellularum bicrenatis late distinctis, apicibus 4-crenatis (qui includunt ambos angulos apicales) crenis plus distincte bigranulationibus quam in forma typica, granulis marginalibus in seriebus duobus visibilibus, granulis centralibus variabilibus prae numero et ordinatione et aliquanto reductis vel interdum quaternis vel circa 9 in tribus seriebus verticalibus. Long. 20-27 $\mu$ , Lat. 18-24 $\mu$ , Lat. isth. 5.6-8.4 $\mu$ .

Hab. **Hokkaido**: Tôroko in Kushiro; Sarufutsu in Kitami. **Hondo**: Izu-numa in Rikuzen; Mohara in Kamifusa; Ôniu-ike on Mt. Norikura in Etchû; Daizahôshi-ike in Shinano; Takashihara, Ô-numa in Mikawa; Fuse-ike in Oomi; Shakuhashi-ike, Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Ahira in Ôsumi; Ôhatayama of Mt. Kirishima in Hiuga. (New to Japan) (Pl. XXVIII, f. 13)

Distr. Corea, China, Europe.

***Cosmarium subalatum*** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 63, 1895; Monogr. Brit. Desm. 3, 255, 1908.

Cellulae parvae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari alte leviter dilatato; semicellulae truncato-pyramidatae, marginibus lateralibus 3-crenatis (cum angulis apicalibus et basalibus rotundis), crenis medianis et basalibus paene aequalibus vel crenis basalibus leviter maioribus quam crenis medianis, apicibus truncatis paullo 4-crenatis (cum angulis apicalibus), crenis omnibus granulatis, generaliter duobus granulis sed in crenis basalibus trigranulatis et in crenis apicalibus granulis singulis acutis leviter maioribus ornatis, intra marginem granulis minutis in seriebus duobus radialibus et concentricis bigranulorum ornatis, in centro cum granulato-protuberantia, granulis 7 (6 periphericis aequalibus, 1 centrali majori); a latere visae ovatae, cum tumore ad basim utrobique; a vertice visae ellipticae, lateribus cum 3-granulato-tumore in medio utrobique. Long.  $23.7\mu$ , Lat.  $21.5\mu$ , Lat. isth.  $8.6\mu$ .

Hab. **Hondo**: Akaiyachi in Iwashiro; Onjaga-ike in Kamifusa. (New to Japan) (Pl. XXVIII, f. 20, 21)

Distr. Burma, Europe, central Africa, Madagascar.

**Cosmarium subcostatum** NORDST. in Ofvers K. Vet. Akad. Förh. 37, 1876; SCHMIDLE Ber. Dtsch. Bot. Ges. 10, 208, 1892; WEST Monogr. Brit. Desm. 3, 236, 1908; INSAM & KRIEGER Hedw. 76, 109, 1937.

Cellulae submediocres, circiter  $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu angusto-lineari alte leviter dilatato; semicellulae aliquantum reniforme-subtrapeziformes, angulis basalibus rotundis, marginibus lateralibus convexis crenatis, crenis lateralibus circa 4, crenis basalibus duabus inferioribus quam crenis lateralibus duabus superioribus, crenis superioribus emarginatis bigranulatis, crenis inferioribus duabus granulis nullis vel reductis in granulos singulos interdum duo, apicibus truncatis minute 4-crenatis; membrana cum granulis in seriebus radiantibus 2-3 bigranulorum minutorum intra et prope marginem, reductibus et simplicibus ad medium ordinatis, in centro cum granulato-tumore supra isthmum, granulis centralibus tumorum in serie subverticalibus 3-4 ordinatis; a latere visae ovatae, lateribus cum tumoribus ad basim utrobique; a vertice visae ellipticae, granulato-tumore in medio utrobique. Long.  $34.4\mu$ , Lat.  $28\mu$ , Lat. isth.  $6.5\mu$ .

Hab. **Hondo**: Hakuryu-ko in Uzen. (New to Japan) (Pl. XXVIII, f. 26)

Distr. Ceylon, Europe, Greenland, Arctic Canada, W. Indies.

forma **minor** W. & G. S. WEST in Journ. Bot. 34, 379, 1896; Monogr. Brit. Desm. 3, 238, 1908; KRIEGER Arch. Hydrobiol. suppl. 11, 186, 1932.

Cellulae minores. Long.  $26.6\mu$ , Lat.  $22.4\mu$ , Lat. isth.  $9\mu$ .

Hab. **Hokkaido**: Koetoi-konuma in Kitami; Nakano near Sapporo in Ishikari. (New to Japan) (Pl. XXVIII, f. 27)



Distr. Mongolia, Java, Europe, U. S. A., Africa.

**Cosmarium formosulum** HOFF. in WEST Monogr. Brit. Desm. 3, 249, 1908; DICK Mitt. Pfälz. Ver. Nat. Pollichia 3, 127, 1930; CARTER Journ. Linn. Soc. Bot. 50, 163, 1935; OKADA ASAHINA's Inkwa. 167, 1939; TAFT Ohio Journ. Sci. 45, 194, 1945.

Cellulae submediocres, circiter tam longae quam latae vel leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae semicirculari-trapeziformes, angulis basalibus rotundis, marginibus lateralibus convexis et 6-7 crenatis, apice truncato et paullo 5-undulato, tribus medianis parvis, angulis apicalibus obtusis; membrana granulata, granulis in seriebus concentricis tribus intra totum marginem, seriebus omnibus binatis sed singulis in serie interiore, in centrum supra isthmum cum granulato-tumore lato, granulis in serie 5 verticali ordinatis; a latere visae late ovatae cum granulato-tumore ad basim utrobique; a vertice visae angusto-ellipticae, lateribus cum late crenulato-tumore ad medium utrobique, polis rotundis et minute crenulatis, apice semicellularum glabro et quadrato. Long.  $34\mu$ , Lat.  $34\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hokkaido**: Okineppe in Nemuro. (New to Japan) (Pl. XXVIII, f. 25)  
Distr. Kuriles, Manchuria, S. China, Europe, Iceland, S. Africa.

var. **mesochondrium** (SCHMIDLE) HIRANO, comb. nov.

*Cosmarium mesochondrium* SCHMIDLE in Hedw. 34, 85, 1895.—*Cosm. formosulum* HOFF. in WEST Monogr. Brit. Desm. 3, 242, 1908; TAYLOR & COLTON Amer. Journ. Bot. 15, 608, 1928.

Var. margine laterali semicellularum inaequaliter 4-5 crenato, marginibus lateralibus inferioribus maioribus quam superioribus ceteris, integris vel minute tricrenatis, crenis tribus superioribus aequalibus, apice potius angusto-truncato et paullo retuso, granulis centralibus indistinctis. Long.  $37.8-39\mu$ , Lat.  $30-31\mu$ , Lat. isth.  $9.8-11\mu$ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Horomui in Ishikari. (New to Asia) (Pl. XXVIII, f. 35)

Distr. U. S. A.

**Cosmarium retusum** (PERTY) RABENH. var. **angustatum** W. & G. S. WEST in Journ. Linn. Soc. Bot. 29, 143, 1892; Monogr. Brit. Desm. 3, 266, 1908.

Var. cellulis angustioribus et longioribus; semicellulis subtriangulari-rotundis, marginibus lateralibus leviter convexis, sed aliquando retusis in parte superiore, apicibus angusto-truncatis leviter convexis; membrana dense punctata, punctulis in seriebus radiantibus ornatis; a latere visae ovatae. Long.  $39-42\mu$ , Lat.  $28-31\mu$ , Lat. isth.  $7.8-9.8\mu$ .

Hab. **Hondo**: Daizahôshi-ike in Shinano; Ariga-ike in Yamashiro. (New to Asia) (Pl. XXVIII, f. 4)

Distr. Ireland.

Our form of this variety does not exactly coincide with the European description given by W. & G. S. WEST because the lateral angle of semicell is rectangularly rounded and not undulating as British form, and the punctations are regularly and densely disposed and do not show any differentiation between them.

**Cosmarium Malinvernianum** (RACIB.) SCHMIDLE in MIGULA Krypt. Fl. 2, 455, 1907; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 32, 1921.—*Cosmarium subtholiforme* RACIB. var. *Malinvernianum* RACIB. in Pamiętn. Wydz. Akad. Um. Krakow 17, 19, 1889. (reprint?)

Cellulae modicae, circiter  $1\frac{1}{2}$  longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae subrectangulares vel subtrapeziformes, angulis basalibus rectangulari-rotundis, marginibus lateralibus convexis alte convergentibus, apicibus truncatis rectis, angulis apicalibus bene rotundis; membrana valde conico-granulata, granulis conicis acutis in seriebus concentricis prope marginem, sed ad centrum reductis, in centro semicellularum cum inflatione scrobiculata; a latere visae ellipticae, lateribus supra basim utrobique cum inflatione mediana, conico-granulis in seriebus verticalibus a basi ad apicem ordinatis; a vertice visae oblongae, lateribus cum inflatione in medio utrobique, conico-granulis in seriebus transversis a polo ad polum ordinatis, centro glabro. Long.  $86-103\mu$ , Lat.  $64.5-68.8\mu$ , Lat. isth.  $22.7-25.8\mu$ .

Hab. **Hondo**: Kôriyama, Akaiyachi in Iwashiro; Oze-numa in Kôzuke; Inago of Kitamaki-mura in Shinano; Kotsutsumi-nishi-ike in Mikawa; Biwa-ike in Owari; Shinohara-ike in Oomi; Ko-ike in Yamashiro. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Asia) (Pl. XXVIII, f. 6)

Distr. Europe.

The breadth of our form of *Cosmarium Malinvernianum* is somewhat larger than the European dimension, but its conical granules and their arrangement well shows the character of the species.

**Cosmarium paulense** (BÖRGES.) JOHNSON var. **japonicum** HIRANO in Act. Phytotax. Geobot. 14, 36, 1950.

Semicellulae cum serie scrobiculis ad centrum, sine granulis intra marginem lateralem, sinu angusto-lineari. Long.  $52\mu$ , Lat.  $39\mu$ , Lat. isth.  $11.2\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (Pl. XXVIII, f. 2)

Distr. Japan.

**Cosmarium binodulum** REINSCH in LÜTKEMÜLLER Ver. zool.-bot. Ges. Wien 484, 1910.

Cellulae submediocres, elliptico-hexagonales, circiter longiores quam latae, profunde constrictae, sinu angusto-lineari in capite leviter dilatato; semicellulae

truncato-pyramidatae, angulis basalibus rectangulari-rotundis, marginibus lateralibus convexis 6-7 undulatis (cum angulis basalibus et apicalibus), angulis apicalibus obtusis, apicibus paene truncatis leviter 4-undulatis cum angulis apicalibus; semicellulae cum verrucis duabus magnis infra apicem et granulis quaternis parvis transversaliter infra verrucas dispositis, in centro cum punctulis dispositis, ceteris glabris; a latere visae circulares, lateribus prope apicem utrobique verrucis magnis dispositis; a vertice visae rhomboido-oblongae, cum paullo inflatione in medio lateris utrobique. Long. 34.4-36.4 $\mu$ , Lat. 28-29 $\mu$ , Lat. isth. 8.4-10.8 $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi; Ko-numa in Oshima. **Hondo**: Ôishita, Chûkawa-ike in Uzen. (New to Asia) (Pl. XXVIII, f. 33)

Distr. Germany, France.

**Cosmarium binum** NORDST. in WEST Monogr. Brit. Desm. 3, 246, 1908; TAYLOR Pap. Mich. Acad. Sci. 19, 250, 1934; CARTER Journ. Linn. Soc. Bot. 50, 162, 1935; MESSIKOMMER Hedw. 78, 144, 183, 1938; HIRANO Act. Phytotax. Geobot. 12, 83, 1943.

Cellulae mediocres, circiter 1 $\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae transverse reniformes vel pyramidato-trapeziformes, angulis basalibus rotundis vel subrectangularibus, marginibus lateralibus convexis crenatis, cum crenis 7-10 utrobique, apicibus leviter convexis 4-crenatis, cum crenis per totum aequalibus, in seriebus concentricis 3-4 intra marginem regulariter ordinatis, crenis omnibus granulis binis regulariter ordinatis, sed in centro reductis, supra isthmum cum conspicuo granulato-tumore, granulis in seriebus 6-8 verticalibus confertis infra tumorem cum seriebus horizontalibus 6-8 granulorum rotundorum ordinatis; a latere visae ovato-oblongae, lateribus cum tumore granulato prominenti in basim utrobique; a vertice visae elliptico-oblongae, in medio utrobique cum tumore granulato prominenti, duobus granulis in seriebus verticalibus trans apicem semicellularum sed glabris in centro. Long. 50-56 $\mu$ , Lat. 36-42 $\mu$ , Lat. isth. 11-14 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Minenobu in Ishikari; Numanohata, Tôasa, Yûfutsu, Tomakomai in Iburi; Junsai-numa, Ko-numa in Oshima. **Hondo**: Hosonuma, Futatsuyagata, Hirumonuma, Megata, Kotomonuma, Moritake ôtsutsumi, Kiriwano in Ugo; Kyutai, Kotsutsumi in Mutsu; Eboshi-numa, Tamamushi-numa, Ôishita, Chûkawa-ike, Mazawano-naga-numa in Uzen; Izu-numa, Keshonuma in Rikuzen; Umaushi-numa, Nanko, Hibushinuma in Iwaki; Akaiyachi, Kôriyama, Nogiwano-kwannon-ike, Kagami-ishimura in Iwashiro; Ozegahara, Ômine-numa in Kôzuke; Higusa-numa in Shimofusa; Inago of Kitamaki-mura, Ôhanami-ike, Ashinota-ike, Lake Nakatsuna in Shinano; Takashihara, Ônuma, Suhara-ike, Kotsutsumi-nishi-ike in Mikawa;

Biwa-ike in Owari; Ishigaki-ike in Ise; Nukigawa, Shinohara-ike, Fuse-ike in Oomi; Shaku-hachi-ike, Takaraga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Kagami-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ōsumi. (Pl. XXVIII, f. 24)

Distr. S. China, India, Ceylon, Sumatra, Europe, N. America, Brazil, Australia, central Africa.

**Cosmarium subspeciosum** NORDST. in Ofvers K. Vet. Akad. Förh. 22, 1875; WEST Monogr. Brit. Desm. 3, 252, 1938; BÖRGESSEN Meddel. Grönl. 43, 83, 1910; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 47, 49, 1920; PRESCOTT Pap. Mich. Acad. Sci. 21, 139, 1936; INSAM & KRIEGER Hedw. 76, 109, 1937.

Cellulae mediocres, circiter  $1\frac{1}{2}$  longiores quam latiores, profunde constrietae, sinu angusto-lineari extremo leviter ampliato; semicellulae pyramidato-semicirculares, marginibus crenatis, crenis lateralibus circa 6 (cum angulis basalibus et apicalibus), apicibus truncatis rectis et 4-crenatis (duobus medio minoribus), crenis infimis cum granulis singulis, reliquis in ambitu toto granulis duobus ad marginem, seriebus radiantibus granulorum 2-3 intra crenaturam marginem, in medio semicellularum cum granulato-tumore, granulis in seriebus verticalibus circa 6, seriebus 3-4 granulorum; a latere visae ovatae, lateribus cum paulo inflatione ad basim; a vertice visae ellipticae, lateribus utrobique paulo inflatione praeditis. Long.  $41\mu$ , Lat.  $32\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hokkaido**: Tokotan in Kushiro. (New to Japan) (Pl. XXVIII, f. 28)

Distr. Siberia, Ceylon, Europe, Spitzbergen, Greenland, Nova Zembla, N. America, Brazil, Africa.

var. **validius** NORDST. in K. Sv. Vet. Akad. Handl. 22, 49, 1883; JOHNSON Bull. Torrey Bot. Club 22, 294, 1895; WEST Monogr. Brit. Desm. 3, 253, 1938; KRIEGER Arch. Hydrobiol. suppl. 11, 187, 1932.

Var. maiores, semicellulae cum crenis lateralibus circa 8-9, granulato-tumoribus vix visis, seriebus circa 5-6 verticalibus. Long.  $73\mu$ , Lat.  $56\mu$ , Lat. isth.  $20\mu$ .

Hab. **Hokkaido**: Tokotan in Kushiro. (New to Japan) (Pl. XXVIII, f. 32)

Distr. Manchuria, Java, Borneo, N. & S. America, New Zealand, Madagascar.

### Sect. **Tetridium** TURNER emend. HIRANO

*Cosmarium* subgen. *Tetridium* TURNER in K. Sv. Vet. Akad. Handl. 25, 74, 1893.

Semicellulae rectangulares vel polygonales, granulis vel verrucis regulariter vel irregulariter ordinatis.

- 1a. Semicellulae rectangulares, angulis apicalibus late rotundis, lateribus parallelis.
- 2a. Granula non diversa in dispositionem et amplitudinem.
- 3a. Cellulae magnae, 60-105 $\mu$  in longitudinem.
  - 4a. Membrana granulata, inter granulos punctata ..... *C. margaritatum*
  - 5a. Cellulae 66-105 $\mu$  in longitudinem ..... f. *typica*
  - 5b. Cellulae 38-50 $\mu$  in longitudinem ..... var. *minor*
  - 4b. Membrana granulata, inter granulos glabra ..... *C. Quadrum*
  - 5a. Cellulae 50-90 $\mu$  in longitudinem ..... f. *typica*
  - 5b. Cellulae 40-50 $\mu$  in longitudinem ..... var. *minus*
  - 3b. Cellulae parvae, 33-38 $\mu$  in longitudinem ..... *C. pseudobroomel*
  - 3c. Cellulae minutae, 17-20 $\mu$  in longitudinem ..... *C. ozense*
- 2b. Granula diversa in dispositionem et amplitudinem
  - ..... *C. ungerianum* var. *bohemicum*
- 1b. Semicellulae obverse subtrapeziformes, lateribus divergentibus ..... *C. latifrons*

**Cosmarium margaritatum** (LUND.) ROY & BISSET in Journ. Bot. 24, 194, 1886; WEST Monogr. Brit. Desm. 4, 18, 1911; TAYLOR Pap. Mich. Acad. Sci. 19, 257, 1934; OKADA ASAHINA's Inkwa. 171, 1939; TAFT Ohio Journ. Sci. 45, 196, 1945; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 23, 1953.

Cellulae modicae, circiter 1 $\frac{1}{4}$ —1 $\frac{1}{2}$  duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in apice leviter dilatato; semicellulae subrectangulares, angulis basalibus rectangulari-rotundis, marginibus lateralibus convexis, angulis apicalibus late rotundis, apicibus rectis vel leviter convexis; membrana granulata, granulis in seriebus verticalibus ordinatis et inter granulos punctata; a latere visae subcirculares; a vertice visae oblongo-ellipticae. Long. 78-84 $\mu$ , Lat. 70-72 $\mu$ , Lat. isth. 22-25 $\mu$ .

Hab. **Hondo**: Kashima-cho in Iwaki; Lake Biwa in Oomi. **Kiushiu**: Kagami-ike, Nakahama of Lake Ikeda in Satsuma. (Pl. XXIX, f. 3)

Distr. Japan, China, Ceylon, Malay, Europe, Greenland, N. America, Africa.

forma **minor** (BOLDT) W. & G. S. WEST in Monogr. Brit. Desm. 4, 19, 1911; TAYLOR Pap. Mich. Acad. Sci. 19, 257, 1934.

Cellulae parvior quam in forma typica. Long. 58-59 $\mu$ , Lat. 54 $\mu$ , Lat. isth. 18-19 $\mu$ .

Hab. **Hondo**: Izu-numa in Rikuzen. (New to Asia) (Pl. XXVIII, f. 37)

Distr. Greenland, Africa.

**Cosmarium Quadrum** LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 25, 1871; MIGULA Krypt. Fl. 2, 480, 1937; WEST Monogr. Brit. Desm. 4, 20, 1911; OKADA Bull. Biogeogr. Soc. Jap. 3, 50, 1932; INSAM & KRIEGER Hedw. 76, 107, 1937; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 23, 1953.

Cellulae modicae, quadratae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari sed dilatato ad apicem; semicellulae trans-

verse subrectangulares, marginibus lateralibus paene parallelis convexis et aliquantum leviter divergentibus in parte inferiore, angulis basalibus rotundis, angulis apicalibus late rotundis, apicibus late rectis vel leviter retusis; membrana dense granulata, granulis in seriebus verticalibus circa 14-17 transverse semicellulae ordinatis, inter granulos glabra; a vertice visae elliptico-oblongae, lateribus rectis et parallelis, granulis aliquantum in seriebus concentricis ordinatis; a latere visae subcirculares. Long. 53-90 $\mu$ , Lat. 47.6-85 $\mu$ , Lat. isth. 19-30 $\mu$ .

Hab. **Hondo**: Mt. Komagatake in Ugo; Lake Biwa in Oomi; Ariga-ike, Shakuhashi-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Kagami-ike in Satsuma. (Pl. XXVIII, f. 34, Pl. XXIX, f. 1.)

Distr. Japan, Formosa, India, Sumatra, Europe. U. S. A., central Africa.

var. **minus** NORDST. in MIGULA Krypt. Fl. 2, 480, 1907; WEST Monogr. Brit. Desm. 4, 21, 1911; TAFT Ohio Journ. Sci. 45, 198, 1945.

Cellulae minores. Long. 45-51 $\mu$ , Lat. 40-47 $\mu$ , Lat. isth. 17-19 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Horomui in Ishikari; Tomakomai in Iburi. **Hondo**: Gôno-ike in Hitachi; Higusa-numa in Shimofusa; Otari in Echigo; Inago of Kitamaki-mura, Ashinota-ike in Shinano; Matsu-bara-naiko in Oomi. (New to Japan) (Pl. XXIX, f. 2)

Distr. Manchuria, Europe, Greenland, U. S. A.

**Cosmarium pseudobroomei** WOLLE in Bull. Torrey Bot. Club 11, 16, 1884; TURNER K. Sv. Vet. Akad. Handl. 25, 66, 1893; WEST Trans. Linn. Soc. Bot. 6, 170, 1902; MIGULA Krypt. Fl. 2, 465, 1907; WEST Monogr. Brit. Desm. 4, 22, 1911.

Cellulae mediocres, subrectangulares, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae late subrectangulares, angulis basalibus rectangulari-rotundis, marginibus lateralibus convexis et gradatim alte convergentibus, apicibus truncatis rectis, angulis apicalibus late rotundis; membrana granulata, granulis in seriebus 12-13 verticalibus ordinatis; a latere visae paene circulares; a vertice visae oblongae, granulis in seriebus verticalibus et obliquis ordinatis. Long. 34-39 $\mu$ , Lat. 33-36 $\mu$ , Lat. isth. 11-13 $\mu$ .

Hab. **Hokkaido**: Tokotan in Kushiro. **Hondo**: Hizume in Rikuchû; Chûkawa-ike, Ôishitano-junsaitsumi in Uzen; Kashima-cho in Iwaki; Sanpôji-ike in Musashi; Kotsutsumi-nishi-ike, Ô-numa, Suhara-ike in Mikawa; Kanashôzu, Ishigaki-ike, Jôdo-ike in Ise; Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Kagami-ike in Satsuma. (New to Japan) (Pl. XXVIII, f. 36)

Distr. Central China, India, Ceylon, Java, Europe, U. S. A., Brazil,

central Africa.

**Cosmarium Ozense** HIRANO in Act. Phytotax. Geobot. **11**, 97, 1943.

Cellulae parvae, circiter tam longae quam latae vel paullo latiores, profunde constrictae, sinu angusto-lineari; semicellulae oblongo-rectangulares, angulis inferioribus rotundatis, angulis superioribus late rotundatis, apicibus truncatis vel leviter convexis; a latere visae circulares; a vertice visae oblongae; membrana minutissime granulata, granulis dense et leviter concentricis in parte marginis sed horizontalibus in inferiori parte semicellularum. Uno pyrenoido in qualibet semicellula. Long.  $17.4\mu$ , Lat.  $18\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hondo**: Lake Jiue-mon-ike in Kôzuke. (Pl. XXVIII, f. 38)

Distr. Japan.

**Cosmarium ungerianum** (NÄG.) De BARY var. **bohemicum** LÜTKEM. in Verh. zool.-bot. Ges. Wien 495, 1910; KAISER Krypt. Forsch. **1**, 227, 1919.

Var. cellulae minores quam in forma typica, angulis apicalibus late rotundis cum circiter granulis tribus et circa granulos potius magnos intra marginem prope angulos apicales, cum granulis singulis prominentibus juxta supra isthmum, granulis 6-7 aliis ad centrum semicellularum ordinatis. Long.  $53\mu$ , Lat.  $45\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hokkaido**: Tôasa-numa in Iburi. (New to Asia) (Pl. XXIX, f. 5)

Distr. Central Europe.

**Cosmarium latifrons** LUND. in WEST Monogr. Brit. Desm. **4**, 33, 1911; SKUJA Act. Horti Bot. Univ. Latv. **3**, 160, 1928.

Cellulae mediocres, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari in extremo leviter ampliato; semicellulae subhexagono-reniformes, marginibus lateralibus inferioribus divergentibus et longioribus quam superioribus, marginibus lateralibus superioribus et inferioribus ambo leviter convexis, angulis lateralibus obtuse-rotundatis, apicibus latis et paullo rectis, angulis apicalibus et basalibus obtusis; membrana subtiliter granulata, granulis in serie radiali ad marginem, circa 22 in ambitu toto marginis, in medio semicellularum serie verticali tribus granulorum magnorum; a latere visae ovatae, cum inflatione granulato ad basim lateris utrobique; a vertice visae rhomboido-ellipticae, lateribus trigranulato-inflatione ad medium utrobique. Long.  $33.6\mu$ , Lat.  $33.6\mu$ , Lat. isth.  $14\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Tôasa-numa, Yûfutsu in Iburi; Shizukari in Oshima. (New to Japan) (Pl. XXIX, f. 4)

Distr. Siberia, Europe.

Subgen. **Nothocosmarium** RACIB.

*Cosmarium* subgen. *Nothocosmarium* Pamietn. Wyd. Um. Krakow 98, 1889.

Cellulae quadratae, modice constrictae, in latere visae asymmetricae, a vertice visae semicirculares vel semiellipticae.

Species unica ..... **C. obliquum** forma **tatrica**

**Cosmarium obliquum** NORDST. forma **tatrica** GUTW. in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 48, 1935; HIRANO Bot. Mag. 66, 205, 1953.—*Cosmarium obliquum* NORDST. in ALLORGE Rev. Alg. 5, 337, 1930; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS. Pl. Crypt. 2, 84, 1934; PRESCOTT Pap. Mich. Acad. Sci. 21, 137, 1936; INSAM & KRIEGER Hedw. 76, 103, 1937.

Forma marginibus lateralibus valide retusis, angulis basalibus rotundioribus, in parte superiore semicellularum latioribus quam in inferioribus, apicibus leviter retusis. Long. 14–27 $\mu$ , Lat. 12–20 $\mu$ , Lat. isth. 10–14 $\mu$ .

Hab. **Hokkaido**: Kamikoshi-ukishimahara, Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Kurikoma, Yatsumanako of Mt. Iwate in Rikuchû; Mt. Komagatake in Ugo; Mt. Gassan, Mt. Azuma, Sugigamine of Mt. Zawo in Uzen; Ayamedaira of Oze in Kôzuke; Sennin-ike, Mt. Tateyama, Mt. Eboshi, Tarobei-daira, Kumonotaira in Etchû; Happô-ridge, Tengunohara, Kazafuki-koshiki-ike, Shigakôgen in Shinano; Sawano-ike in Yamashiro. **Kiushiu**: Koshiki-ike of Mt. Kirishima in Hiuga. (Pl. XXVIII, f. 39)

Distr. Japan, Europe, N. America.

**Arthrodesmus** EHRENB.

RALFS Brit. Desm. 117, 1848; RABENHORST Flor. Europ. Alg. III, 225, 1868; WEST Monogr. Brit. Desm. 4, 88, 1911; SMITH Wisc. Bull. 57, 125, 1924; WEST & FRITSCH Treat. Brit. Alg. 280, 1927; PRINTZ in ENGLER's Pflanzenfam. 3, 356, 1927; SMITH Freshw. Alg. U. S. 584, 1933.

Cellulae parvae aliquando minutae generaliter tam longae quam latae sine spinis, conspicue et profunde constrictae, sinu generaliter aperto, raro lineari; semicellulae in fronte visis generaliter obverse triangulares aliquando ellipticae, subquadratae, trapeziformes cum spinis simplicibus rectis vel curvatis ad angulos praeditae, earumque in centro planae glabrae non differentiatæ; a vertice visae generaliter ellipticae spinis ad polos praeditae; membrana unius crassata et sine quolibet ornamento; chromatophoris axialibus cum pyrenoidibus in unaquaque semicellula; zygosporae globosae, membrana glabra vel cum spinis simplicibus praedita.

1a. Cellulae spinis singulis ad angulos apicales ordinatae.

2a. Cellulae sine spinis in margine lateralis utrobique ..... Sect. **Tetracanthum**

2b. Cellulae cum spinis singulis in margine lateralis utrobique .. Sect. **Octacanthum**



- 1b. Cellulae spinis duabus ad angulos apicales et spinis singulis in margine lateralis utrobique ordinatae ..... Sect. **Diplocanthum**

### Sect. **Tetracanthum** (NÄG.) HANSG.

*Arthrodemus* sect. *Tetracanthum* (NÄG.) HANSG. in WEST Monogr. Brit. Desm. 4, 89, 1911.  
—subgen. *Aplodesmus* TURNER in K. Sv. Vet. Akad. Handl. 25, 137, 1893 (pro parte)

Cellulae parvae, lateribus utrobique spinis semper singulis ad angulos ordinatis, spinis longis singulis non duabus.

- 1a. Semicellulae obverse semicirculares, trapeziformes vel triangulares.
  - 2a. Semicellulae obsemicirculares vel subhexagono-trapeziformes.
    - 3a. Sinu acuto, isthmo non elongato ..... **A. Incus**
    - 4a. Semicellulae obsemicirculares.
      - 5a. Margine laterali paullo convexo ..... f. **typica**
      - 5b. Margine laterali valide convexo ..... var. **validus**
    - 4b. Semicellulae obverse subhexagono-trapeziformes.
      - 5a. Apice concavo, spinis divergentibus ..... f. **minor**
      - 5b. Apice convexo, spinis horizontalibus vel paullo divergentibus ..... var. **subhexagonum**
  - 3b. Sinu rotundo et excavato, isthmo elongato ..... **A. quiriferus**
    - 4a. Cellulae 15-17 $\mu$  in longitudinem ..... var. **brevispinis**
    - 4b. Cellulae 10-11 $\mu$  in longitudinem ..... var. **brevispinis** f. **minor**
- 2b. Semicellulae obverse trapeziformes.
  - 3a. Cellulae modicae, 32 $\mu$  in longitudinem ..... **A. Bulnheimii**
  - 3b. Cellulae parvae, 20-24 $\mu$  in longitudinem, in vertice visae elliptico-fusiformes ..... **A. crassus**
  - 3c. Cellulae minutae, 10-15 $\mu$  in longitudinem, in vertice visae ellipticae ..... **A. controversus**
- 2c. Semicellulae obverse triangulares.
  - 3a. Apice non elevato ..... **A. phimus**
    - 4a. Cellulae plus longiores quam latiores, apice late retuso ..... f. **typica**
    - 4b. Cellulae tam longae quam latae vel leviter latiores quam longiores, apice leviter retuso ..... var. **occidentalis**
  - 3b. Apice elevato ..... **A. triangularis**
    - 4a. Sinu rotundo.
      - 5a. Margine laterali recto vel leviter convexo, spinis generaliter horizontalibus.
        - 6a. Cellulae 23-30 $\mu$  in longitudinem ..... f. **typica**
        - 6b. Cellulae 12-13 $\mu$  in longitudinem ..... var. **minor**
      - 5b. Margine laterali undulato, spinis convergentibus ..... var. **latiusculum**
    - 4b. Sinu acuminato ..... var. **acuminatum**
- 1b. Semicellulae rectangulares ..... **A. extensus**
  - 2a. Apice concavo.
    - 3a. Spina divergens ..... f. **typica**
    - 3b. Spina convergens ..... var. **retusum**
  - 2b. Apice convexo-retuso ..... var. **malaccensis**
- 1c. Semicellulae ellipticae vel subellipticae.
  - 2a. Semicellulae ellipticae vel elliptico-hexagonae ..... **A. convergens**
    - 3a. Semicellulae ellipticae ..... f. **typica**

- 3b. Semicellulae elliptico-hexagonae ..... f. *curta*
- 2b. Semicellulae elliptico-reniformes.
- 3a. Spina incurvata et convergens ..... *A. curvatus*
- 3b. Spina recta et divergens ..... *A. subulatus*
- 4a. Margine dorsali et ventrali paene aequali ..... var. *subaequalis*
- 4b. Margine ventre longiore quam dorso.
- 5a. Apice valide convexo ..... f. *typica*
- 5b. Apice paullo convexo ..... var. *Nordstedtii*
- 1d. Semicellulae rhomboides, spinis longis divergentibus ..... *A. rhomboides*

**Arthodesmus Incus** (BRÉB.) HASS. in RALFS Brit. Desm. 118, 1848; WEST Monogr. Brit. Desm. 4, 90, 1911; SMITH Wisc. Bull. 57, 131, 1924; IRÉNÉE-MARIE Nat. Canad. 76, 39, 1949; HIRANO Jap. Journ. Bot. 14, 229, 1954.

Cellulae parvae, circiter tam longae quam latae vel leviter longiores, profunde constrictae, sinu late aperto; semicellulae obverse triangulares vel subtrapeziformo-triangulares, marginibus ventralibus convexis, apice recto vel leviter concavo, angulis apicalibus cum spina longa robusta praeditis, spinis alte divergentibus; a vertice visae ellipticae, polis spina longa robusta praeditis; membrana glabra. Long. sine spin. 15–20 $\mu$ , Lat. sine spin. 14–17 $\mu$ , Lat. isth. 6.4–8.4 $\mu$ .

Hab. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Kurikoma in Ugo; Hakuryu-ko, Mt. Gassan in Uzen; Naga-numa in Rikuzen; Oze in Kôzuke; Mohara in Kamifusa; Mt. Naeba, Takayachi, Kurosawano-ike on Mt. Myôko in Echigo; Shigakôgen, Mt. Kirigamine in Shinano; Takashihara, Suhara-ike in Mikawa; Mt. Hira in Oomi. **Kiushiu**: Yabakei in Bunzen. (Pl. XXIX, f. 37)

Distr. Japan, Siberia, India, Java, whole Europe, Iceland, Greenland, N. & W. America, New Zealand.

forma **minor** W. & G. S. WEST in Monogr. Brit. Desm. 4, 92, 1911; ALLORGE Rev. Alg. 5, 363, 1930; HIRANO Bot. Mag. 66, 206, 1953.

Cellulae minores, semicellulae obverse trapeziformo-triangulares, sinu rectangulari, spinis apicalibus brevibus. Long. sine spin. 11–15 $\mu$ , Lat. sine spin. 11–14.5 $\mu$ , Lat. isth. 5.6 $\mu$ , Long. spin. 5.6 $\mu$ .

Hab. **Hokkaido**: Numanotaira on Mt. Daisetsu in Ishikari; Tomakomai in Iburi. **Hondo**: Mt. Hachimantai in Mutsu; Hirumo-numa, Koke-numa in Ugo; Mt. Kurikoma in Rikuchû; Mt. Sugigamine of Zawo, Mt. Gassan, Mt. Azuma in Uzen; Numanotaira on Mt. Bandai in Iwashiro; Oze in Kôzuke; Shimizu-daira on Mt. Nasu in Shimotsuke; Mt. Naeba in Echigo; Kumonotaira, Tarobei-daira, Kurobe-gorodaira, Mt. Tateyama in Etchû; Mt. Kirigamine, Mt. Kazafuki, Happô-ridge, Tengenohara in Shinano; Kotsutsumi-nishi-ike in Mikawa. (Pl. XXIX, f. 27)

Distr. Japan, Europe.

var. **validus** W. & G. S. WEST in Journ. Linn. Soc. Bot. **33**, 320, 1898; Monogr. Brit. Desm. **4**, 96, 1911; KRIEGER Arch. Hydrobiol. suppl. **11**, 191, 1932.

Cellulae maiores, semicellulae obverse semicirculares, apicibus rectis, spinis longissimis et robustis. Long. sine spin.  $22.4\mu$ , Lat. sine spin.  $21\mu$ , Lat. isth.  $7-9.5\mu$ , Long. spin.  $22\mu$ .

Hab. **Hondo**: Koke-numa in Ugo; Ozegahara in Kôzuke. (Pl. XXIX, f. 28)

Distr. Japan, Ceylon, Sumatra, British Isles, U. S. A.

var. **subhexagonum** (W. & G. S. WEST) HIRANO, stat. nov.

*Arthrodesmus Incus* (BRÉB.) HASS. var. *Ralfsii* W. & G. S. WEST forma *subhexagona* W. & G. S. WEST in Monogr. Brit. Desm. **4**, 96, 1911; BORGE Bot. Notis. **24**, 1913; HIRANO Journ. Jap. Bot. **20**, 49, 1944.

Cellulae minores, semicellulae late et transverse subhexagono-semicirculares, spinis brevibus. Long.  $16\mu$ , Lat. sine spin.  $15.4\mu$ , Lat. isth.  $5.6\mu$ .

Hab. **Kiushiu**: Bôgatsuru on Mt. Kujû in Bungo. (Pl. XXIX, f. 7)

Distr. Japan, Sweden, Scotland.

**Arthrodesmus quiriferus** W. & G. S. WEST var. **brevispinis** OKADA in Journ. Imp. Fish. Inst. **30**, 179, 1934; HIRANO Jap. Journ. Bot. **14**, 229, 1954.

Cellulae minores, sinu rotundiori, paene submamillato ad verticem, spinis aequae brevibus; membrana fine punctata. Long. sine spin.  $14-17\mu$ , Lat. sine spin.  $10-15\mu$ , Lat. isth.  $6-7\mu$ , Long. spin.  $9-10\mu$ .

Hab. **Hokkaido**: Mt. Daisetsu, Kamikoshi-ukishimahara, Nopporo in Ishikari. **Hondo**: Ôyachi of Mt. Hachimantai in Rikuchû; Koke-numa in Ugo; Numanotaira on Mt. Bandai in Iwashiro; Ozegahara in Kôzuke; Kurosawano-ike on Mt. Myôko in Echigo; Shigakôgen in Shinano. (Pl. XXIX, f. 33)

Distr. Japan, N. Kuriles.

forma **minor** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, **19**, 67, 1948.

Forma minor, spinis mediocriter longis. Long. sine spin.  $10.7\mu$ , cum spin.  $19.3\mu$ , Lat. sine spin.  $7.7\mu$ , cum spin.  $18\mu$ , Lat. isth.  $3.4\mu$ .

Hab. **Hondo**: Ko-ike in Yamashiro. (Pl. XXIX, f. 34)

Distr. Japan.

**Arthrodesmus Bulnheimii** RACIB. in Pamietn. Wydz. Um. Krakow **95**, 1889; WEST Monogr. Brit. Desm. **4**, 105, 1911.

Cellulae mediocres, leviter longiores quam latiores sine spinis, profunde constrictae, sinu angusto-lineari ad verticem sed extrorsum aperto; semicellulae nonnihil obverse subsemicirculares et aliquando obverse subtrapeziformes, marginibus lateralibus valide convexis, apicibus paullo convexis,

angulis apicalibus cum spina longa robusta divergenta; a vertice visae ellipticae, polis spina robusta longa ordinatis; membrana glabra. Long. sine spin.  $32.3\mu$ , Lat. sine spin.  $30\mu$ , Lat. isth.  $7.7\mu$ .

Hab. **Hokkaido**: Shizukari in Oshima. (New to Asia) (Pl. XXIX, f. 15)  
Distr. Europe.

**Arthrodesmus crassus** W. & G. S. WEST in Monogr. Brit. Desm. 4, 102, 1911; BERGE Ark. Bot. 23A, 40, 1930; HIRANO Bot. Mag. 66, 206, 1953.

Cellulae parvae, circiter longiores quam latiores, modice constrictae, sinu late aperto et leviter acuminato ad apicem; semicellulae obtrapeziformes, marginibus lateralibus convexis, apice leviter convexo vel nonnumquam paene recto, angulis apicalibus acutis cum spinis brevibus divergentibus; a vertice visae late ellipticae, polis acutis spinatis, spinis brevibus. Long.  $17-22\mu$ , Lat.  $14-21.5\mu$ , Lat. isth.  $8.6-11\mu$ .

Hab. **Hondo**: Mt. Komagatake in Ugo; Kaminotake in Etchû; Shimono-koike of Shigakôgen in Shinano; Tanuki-numa in Suruga. (Pl. XXIX, f. 39)  
Distr. Japan, Europe, Canada.

**Arthrodesmus controversus** W. & G. S. WEST in Monogr. Brit. Desm. 4, 103, 1911; ALLORGE Rev. Alg. 5, 363, 1930; HIRANO Bot. Mag. 66, 206, 1953.

Cellulae parvae, circiter tam longae quam latae, modice constrictae, sinu aperto et paene rectangulari extremo leviter acuminato; semicellulae late cuneatae vel obverse subtrapeziformes, marginibus lateralibus et apicalibus convexis, angulis apicalibus subacutis et in spinam brevem divergentem productis; a latere visae circulares; a vertice visae ellipticae, polis subacutis cum spinis brevibus; membrana glabra. Long.  $14\mu$ . Lat. sine spin.  $14\mu$ , Lat. isth.  $9.8\mu$ , Long. spin.  $0.7\mu$ .

Hab. **Hondo**: Shimizu-daira on Mt. Nasu in Shimotsuke; Kamino-tanbo in Shinano; Mt. Hira in Oomi. (Pl. XXIX, f. 14)

Distr. Japan, Europe.

**Arthrodesmus phimus** TURNER in K. Sv. Vet. Akad. Handl. 25, 136, 1893; WEST Trans. Linn. Soc. Bot. 5, 192, 1902; Monogr. Brit. Desm. 4, 104, 1911; HIRANO Jap. Journ. Bot. 14, 229, 1954.

Cellulae parvae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto et rectangulari ad apicem acuminato; semicellulae obverse subtriangulares vel late cuneatae, marginibus lateralibus convexis, apicibus retusis, angulis apicalibus subacutis spinis robustis divergentibus ordinatis; a vertice visae angusto-ellipticae, polis rotundis cum spinis brevibus; membrana glabra. Long. sine spin.  $19.4-21\mu$ , Lat. sine spin.  $16.8-21\mu$ , Lat. isth.  $8.4-8.8\mu$ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Hachimantai in Rikuchû; Hakuryu-ko in Uzen; Takayachi on Mt. Myôko in Echigo; Nukigawa of Lake Biwa in Oomi. (Pl. XXIX, f. 25)

Distr. Japan, India, Ceylon.

*Arthrodesmus phimus* from Nukigawa has a straight apex of semicell, but the form from Hakuryu-ko is quite typical and coincides with the TURNER's original description. I have met with an interesting form from Shira-ike that has a deeply retused apex.

var. **occidentalis** W. & G. S. WEST in trans. Roy. Irish Acad. 32B, 59, 1902; Monogr. Brit. Desm. 4, 104, 1911; HIRANO Journ. Jap. Bot. 20, 49, 1944.

Cellulae leviter minores, circiter tam longae quam latae vel leviter latiores, marginibus lateralibus fere rectis autem leviter undulato-convexis, apicibus leviter convexis autem nonnumquam retusis in medio, spinis apicalibus fere rectis vel leviter divergentibus; a vertice visae fusiforme-ellipticae. Long.  $17\mu$ , Lat. sine spin.  $17\mu$ , Lat. isth.  $7.7\mu$ .

Hab. **Hondo**: Happô-ridge in Shinano. **Kiushiu**: Hirabaru of Yabakei in Bunzen. (Pl. XXIX, f. 26)

Distr. Japan, Ireland.

**Arthrodesmus triangularis** LAGERH. in Ofv. K. Vet. Akad. Förh. 42, 244, 1885; WEST Monogr. Brit. Desm. 4, 97, 1911; Ann. Roy. Bot. Gard. Calcutta 6, 211, 1907; SMITH Wisc. Bull. 57, 133, 1924; RICH Journ. Bot. 63, 77, 1925; HIRANO Journ. Jap. Bot. 20, 38, 1944.

Cellulae parvae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto fere rectangulari, isthmo angusto; semicellulae obverse triangulares, marginibus ventralibus leviter convexis, apicibus leviter elevatis et convexis leviter retusis in medio, angulis apicalibus aliquantum rotundis cum spinis longis robustis horizontaliter ordinatis; a vertice visae ellipticae, polis spina longa ordinatis. Long.  $18-25\mu$ , Lat. sine spin.  $15.4-22.4\mu$ , Lat. isth.  $4.2-5.6\mu$ , Long. spin.  $10\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Shizukari in Oshima. **Hondo**: Kariwano, Koke-numa in Ugo; Ukishima-ônuma in Uzen; Izu-numa in Rikuzen; Oze, Ômine-numa in Kôzuke; Kôridonono-ike in Echigo; Mt. Tateyama in Etchû; Kanori-ike in Shinano; Takaraga-ike, Shakuhachi-ike, Sawano-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXIX, f. 22)

Distr. Japan, Burma, Bengal, Europe, N. America, Guiana, Brazil.

var. **minor** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 67, 1948.

Var. minor quam forma typica, isthmo cellularum leviter tortuoso, elongato et cylindrico. Long.  $4.6\mu$ , Lat. sine spin.  $4\mu$ , cum spin.  $12\mu$ , Lat. isth.  $1\mu$ .

Hab. **Hondo**: Sawano-ike in Yamashiro. (Pl. XXIX, f. 18)  
Distr. Japan.

var. **latiusculum** (W. & G. S. WEST) HIRANO, stat. nov.

*Arthrodesmus Incus* (BRÉB.) HASS. var. *Ralfsii* W. & G. S. WEST forma *latiuscula* W. & G. S. WEST in Monogr. Brit. Desm. 4, 96, 1911; SCHULZ Bot. Arch. 2, 137, 1922; HIRANO Bot. Mag. 66, 206, 1953.

Var. marginibus lateralibus semicellularum leviter 2-undulatis, spinis convergentibus. Long. 19.4-25 $\mu$ , Lat. sine spin. 15.4-22 $\mu$ , Lat. isth. 4.2-7 $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Ogata in Ugo; Ôishita, Hijiori-naga-numa, Mazawano-naga-numa, Hakuryu-ko in Uzen; Naga-numa, Kobuchi-numa in Rikuzen; Ojiroi in Iwaki; Oze-numa in Kôzuke; Mohara in Kamifusa; Higusa-numa in Shimofusa; Inago of Kitamaki-mura, Ashinota-ike, Happô-ridge in Shinano; Gakinotanbo in Etchû; Takashihara in Mikawa; Nukigawa of Lake Biwa in Oomi. **Kiushiu**: Yabakei in Bunzen. (Pl. XXIX, f. 24)

Distr. Japan, British Isles.

This variety is somewhat different from the British description in its biundulate lateral margin, slightly elongated isthmus and elevated apex.

var. **acuminatum** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 67, 1948.

Semicellulae levissime elongatae, sinu extremo acuminato. Long. 8 $\mu$ , Lat. sine spin. 6 $\mu$ , cum spin. 16 $\mu$ , Lat. isth. 1.5 $\mu$ .

Hab. **Hondo**: Sawano-ike in Yamashiro. (Pl. XXIX, f. 23)

Distr. Japan.

**Arthrodesmus extensus** (ANDERS.) HIRANO stat. nov.

*Arthrodesmus Incus* (BRÉB.) HASS. var. *extensus* ANDERS. in BERGE Bot. Notis. 25, 1913; SMITH Wisc. Bull. 57, 132, 1924—var. *indentatus* W. & G. S. WEST in Monogr. Brit. Desm. 4, 94, 1911; HIRANO Bot. Mag. 66, 206, 1953.

Cellulae parvae, circiter tam longae quam latae sine spinis, profunde constrictae, sinu excavato et semicirculari, isthmo elongato; semicellulae subrectangulares, angulis basalibus subrectangularibus, marginibus lateralibus superioribus leviter retusis, angulis apicalibus leviter productis et obtusis cum spina longa una divergente directa ordinatis, apice truncato et leviter concavo; a latere visae circulares; a vertice visae ellipticae, polis cum spina ordinatis. Long. sine spin. 13-17 $\mu$ , Lat. sine spin. 14-16.8 $\mu$ , Lat. isth. 5.6-6.3 $\mu$ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu, Akan-junsai-numa in Kushiro; Nikuru-numa, Komukai-ponto, Sarufutsu in Kitami; Tomakomai in Iburi. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu;

Koke-numa, Mt. Komagatake in Ugo; Naga-numa, Izu-numa, Kesho-numa in Rikuzen; Mt. Azuma, Hakuryu-ko, Saigo-mura, Mt. Gassan, Mazawano-naga-numa, Hijiori-naga-numa. Ôishitano-junsai-tsutsumi in Uzen; Kana-zukamura, Takayachi on Mt. Myôko, Kôridonono-ike in Echigo; Oze in Kôzuke; Goda-numa, Higusa-numa in Shimofusa; Mohara in Kamifusa; Gôno-ike in Hitachi; Shira-ike, Ashinota-ike, Happô-ridge, Kazafuki-koshiki-ike, Tengenohara, Mt. Kirigamine in Shinano; Kotsutsumi-nishi-ike, Ôike in Mikawa; Biwa-ike in Owari; Toba in Ise; Fuse-ike, Nukigawa in Oomi; Takaraga-ike, Sawano-ike, Ko-ike, Shakuhashi-ike in Yamashiro. **Kiushiu**: Yabakei in Bunzen; Miyazaki in Hiuga. (Pl. XXIX, f. 16, 17, 35)  
Distr. Japan, Europe, New Foundland.

var **retusum** HIRANO, var. nov.

Var. *semicellulae rectangulares*, *marginibus lateralibus et apicibus retusis*, *angulis apicalibus et basalibus rotundis*, *spinis leviter convergentibus*. Long.  $22.4\mu$ , Lat. sine spin.  $15.4\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hondo**: Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. (Pl. XXIX, f. 38)

var. **malaccensis** (BERNARD) HIRANO, comb. nov.

*Arthrodesmus Incus* (BRÉB.) HASS. var. *malaccensis* BERNARD in Dep. agr. Indes. Néerl. 55, 1909; HIRANO Journ. Jap. Bot. 20, 49, 1944.

Var. *semicellulae obverse trapeziformo-rectangulares*, *marginibus lateralibus superioribus divergentibus et retusis*, *apice convexo et retuso ad medium*, *spinis aliquantum brevibus*. Long.  $16.5\mu$ , Lat. sine spin.  $13\mu$ , Lat. isth.  $3.7\mu$ .

Hab. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXIX, f. 6)

Distr. Japan, Malay.

**Arthrodesmus convergens** EHRENB. in RALFS Brit. Desm. 118, 1848; ROY & BISSET Journ. Bot. 24, 196, 1883; WEST Trans. Linn. Soc. Bot. 5, 234, 1896; Journ. Linn. Soc. Bot. 34, 397, 1899; KAWAMURA Freshw. Biol. 1, 101, 1918; SMITH Wisc. Bull. 57, 126, 1924; OKADA Journ. Imp. Fish. Inst. 30, 177, 1934; TAYLOR Pap. Mich. Acad. Sci. 19, 272, 1934.

Cellulae mediocres, leviter latiores quam longiores sine spinis, profunde constrictae, sinu aperto ad verticem angusto-lineari exterius late aperto; *semicellulae aliquantum ellipticae*, a parte dorsali margine convexiore quam a parte ventrali; *angulis lateralibus acute rotundis cum spina longa incurvata ordinatis*; a vertice visae angusto-ellipticae, polis spinatis; a latere visae circulares; membrana glabra. Long.  $34-42\mu$ , Lat. sine spin.  $36-43\mu$ , Lat. isth.  $10-12\mu$ .

**Hab. Hokkaido :** Akan-junsai-numa, Kiritappu in Kushiro; Nikuru-numa, Komukai-ponto, Shimo-yûbetsu, Furutoi, Sarufutsu in Kitami; Shikaribetsu-woppoto in Tokachi; Horomui, Minenobu in Ishikari; Yûfutsu, Numano-hata, Tôasa-numa, Tomakomai in Iburi; Shizukari in Oshima. **Hondo :** Hirumo-numa, Ogata, Kariwano in Ugo; Hijiori-ônuma, Ôishita, Hakuryuko in Uzen; Izu-numa, Naga-numa, Kesho-numa in Rikuzen; Akaiyachi, Kôriyama in Iwashiro; Umaushi-numa, Kashima-cho in Iwaki; Ozegahara in Kôzuke; Kizaki in Shinano; Tanuki-numa in Suruga; Kotsutsuminishi-ike in Mikawa; Ishigaki-ike, Jôdo-ike, Kanashôzu in Ise; Nukigawa in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu :** Ahira in Ôsumi. (Pl. XXIX, f. 19)

Distr. Japan, Kuriles, Manchuria, Siberia, central China, India, whole Europe, Greenland, Nova Zembla, N. & S. America, New Zealand, Africa.

forma **curta** TURNER in K. Sv. Vet. Akad. Handl. 25, 134, 1893; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 144, 1954.

Semicellulae subhexagonales, sinu angusto-lineari, spinis tenuis. Long. 45-53 $\mu$ , Lat. sine spin. 45-56 $\mu$ , Lat. isth. 13-16.8 $\mu$ .

**Hab. Hondo :** Ishigaki-ike, Tamaru in Ise; Shinohara-ike, Fuse-ike, Lake Biwa in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXIX, f. 20, 21)

Distr. Japan, India.

**Arthrodesmus curvatus** TURNER in K. Sv. Vet. Akad. Handl. 25, 135, 1893; BORGE Hedw. 68, 103, 1928; KRIEGER Arch. Hydrobiol. suppl. 11, 191, 1932; YAMAGUCHI & HIRANO Act. Phytotax. Geobot. 15, 144, 1954.

Cellulae mediocres, circiter tam longae quam latae sine spinis, profunde constrictae, sinu aperto leviter acuminato ad verticem; semicellulae reniforme-rhomboides, marginibus lateralibus inferioribus convexis, marginibus superioribus subconvexis, apice convexo, angulis lateralibus cum spina longa robusta praeditis, spinis leviter convergentibus; a vertice visae oblongo-ellipticae, polis spina praeditis. Long. 32-45 $\mu$ , Lat. sine spin. 36-43 $\mu$ , Lat. isth. 8.4-12.6 $\mu$ .

**Hab. Hokkaido :** Toyokoro in Tokachi; Horomui in Ishikari; Tomakomai in Iburi. **Hondo :** Ôishita in Uzen; Shinohara-ike, Fuse-ike, Lake Biwa in Oomi. (Pl. XXIX, f. 40, 41)

Distr. Japan, India, Sumatra, E. Africa.

**Arthrodesmus subulatus** KÜTZ. in Sp. Alg. 176, 1849; WEST Trans. Linn. Soc. Bot. 5, 72, 1895; Monogr. Brit. Desm. 4, 109, 1911; SMITH Wisc. Bull. 57, 127, 1924; HIRANO Jap. Journ. Bot. 14, 229, 1954.

Cellulae mediocres, leviter longiores quam latiores sine spinis, profunde



constrictae, sinu angusto-lineari exterius aperto; semicellulae elliptico-obsemicirculares, margine ventrali convexiori quam dorsali, angulis lateralibus leviter rotundis cum spinis longis robustis leviter sursum directis ordinatis; a vertice visae ellipticae, polis cum spinis longis rectis ordinatis; membrana subtile punctata. Long.  $33-35\mu$ , Lat. sine spin.  $28-30\mu$ , Lat. isth.  $8.4-10\mu$ , Long. spin.  $15\mu$ .

Hab. **Hokkaido**: Hisago-numa on Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Ôishitano-junsai-tsutsumi in Uzen; Ozegahara in Kôzuke; Shinohara-ike, Fuse-ike in Oomi. (Pl. XXIX, f. 29)

Distr. Japan, India, Abyssinia, Europe, N. & S. America, E. Africa, Madagascar.

var. **subaequalis** W. & G. S. WEST in Monogr. Brit. Desm. 4, 110, 1911; DEFL-ANDRE Bull. Soc. Bot. France 71, 919, 1924.

Cellulae relative latiores et magis angusto-ellipticae, marginibus ventralibus et dorsalibus subaequaliter convexis, spinis subparallelis et leviter divergentibus. Long.  $32-33\mu$ , Lat. sine spin.  $28-29\mu$ , Lat. isth.  $6.3-7\mu$ , Long. spin.  $22-23\mu$ .

Hab. **Hondo**: Ozegahara in Kôzuke (New to Asia) (Pl. XXIX, f. 31)

Distr. British Isles, France, S. Africa.

var. **Nordstedtii** SMITH in Wisc. Bull. 57, 127, 1924.

Var. apicibus cellularum aliquantulum convexis, spinis divergentibus; a vertice visae angusto-ellipticae. Long.  $39\mu$ , cum spin.  $61\mu$ , Lat. sine spin.  $42\mu$ , cum spin.  $72\mu$ , Lat. isth.  $14\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Asia) (Pl. XXIX, f. 30)

Distr. U. S. A.

**Arthrodesmus rhomboides** HIRANO in Act. Phytotax. Geobot. 14, 2, 1949.

Cellulae modicae, leviter latiores quam longiores sine spinis, profunde constrictae, sinu acuto extremo acuminato; semicellulae rhomboides, marginibus ventralibus leviter convexis, angulis lateralibus acutis cum spinis longis robustis divergentibus instructis, apice convexo; a vertice visae anguste ellipticae; a latere visae circulares. Long.  $25\mu$ , Lat. sine spin.  $28\mu$ , Lat. isth.  $6.5\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (Pl. XXIX, f. 36)

Distr. Japan.

#### Sect. **Octacanthum** HANSG.

*Arthrodesmus* sect. *Octacanthum* HANSG. in WEST Monogr. Brit. Desm. 4, 90, 1911.—subgen. *Schizodesmus* TURNER in K. Sv. Vet. Akad. Handl. 25, 137, 1893 (pro parte)

Cellulae parvae vel minutae, lateribus utrobique spinis duabus ad angulos apicales et laterales ordinatae.

1a. Semicellulae rectangulares cum marginibus retusis, spinis longis .. **A. octocornis**

1b. Semicellulae depresso-hexagonae, spinis minutis

..... **A. bifidus** var. **truncatus** f. **succisa**

**Arthrodesmus octocornis** EHRENB. in WOLLE Desm. U. S. 97, 1884; ROY & BISSET Journ. Bot. 24, 196, 1886; HUSTEDT Arch. Hydrobiol. 6, 333, 1911; SMITH Wisc. Bull. 57, 134, 1924; KRIEGER Arch. Hydrobiol. suppl. 11, 192, 1932; OKADA Journ. Imp. Fish. Inst. 30, 179, 1934; HIRANO Jap. Journ. Bot. 14, 229, 1944.

Cellulae parvae, circiter  $1\frac{1}{3}$ — $1\frac{1}{2}$  longiores quam latiores sine spinis, profunde constrictae, sinu late aperto et fere semicirculari excavato; semicellulae transverse trapeziformo-rectangulares, apicibus et marginibus lateralibus omnibus concavis, angulis rotundis et cum spinis longis robustis rectis praeditis; a vertice visae ellipticae, polis rotundis spinis praeditis. Long. sine spin. 17–21.5 $\mu$ , Lat. sine spin. 12–16.8 $\mu$ , Lat. isth. 5–5.6 $\mu$ , Long. spin. 9–10 $\mu$ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Yûfutsu, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Naga-numa of Mt. Hachimantai in Rikuchû; Koke-numa, Hirumo-numa in Ugo; Ôishitano-junsai-tsutsumi, Saigo-mura, Mt. Sugigamine of Zawo in Uzen; Naga-numa, Kobuchi-numa in Rikuzen; Akaiyachi in Iwashiro; Oze in Kôzuke; Mt. Kirigamine in Shinano; Kotsutsumi-nishi-ike, Takashihara in Mikawa; Ishigaki-ike, Jôdo-ike, Toba in Ise; Nukigawa, Shinohara-ike in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXIX, f. 32)

Distr. Japan, Kuriles, Siberia, Mongolia, Burma, Ceylon, Sumatra, whole Europe, Iceland, Greenland, N. America, Australia.

**Arthrodesmus bifidus** BRÉB. var. **truncatus** WEST forma **succisa** W. & G. S. WEST in Monogr. Brit. Desm. 4, 115, 1911.

Cellulae subhexagonales, apicibus et marginibus lateralibus superioribus leviter retusis, sinu leviter rotundis ad apicem, spinis non praeditis. Long. et Lat. 14 $\mu$ , Lat. isth. 5 $\mu$ .

Hab. **Hondo**: Kanori-ike in Shinano. (New to Asia) (Pl. XXIX, f. 11)

Distr. British Isles.

#### Sect. **Diplocanthum** sect. nov.

Cellulae parvae vel minutae, spinis duabus ad angulos apicales utrobique et spinis singulis in margine lateralis utrobique ordinatae.

1a. Semicellulae cum angulis productis ordinatae; cellulae 32 $\mu$  in longitudinem

..... **A. impar**

1b. Semicellulae hexagonae, sine angulis productis; cellulae 12–15 $\mu$  in longitudinem.

- 2a. Semicellulae cum spina in parte apicali ordinatae, marginibus lateralibus inferioribus et superioribus aequalibus ..... **A. tenuissimum**  
 2b. Semicellulae cum spina singulis apicali ordinatae, marginibus lateralibus inferioribus longioribus quam superioribus .... **A. trispinatus** var. **japonicum**

**Arthrodesmus impar** (JACOB.) GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. **49**, 55, 1921; CEDERGREN Ark. Bot. **25**, 67, 1933.—*Arthrodesmus octocornis* EHRENB. forma *impar* JACOB. in WEST Monogr. Brit. Desm. **4**, 113, 1911.

Cellulae mediocres, circiter tam longae quam latae vel leviter longiores sine spinis, profunde constrictae, sinu aperto acutangulo; semicellulae transverse trapeziformo-rectangulares, lateribus concavis, angulis basalibus in spinam longam robustam rectam horizontaliter directam vel leviter deorsum directam praeditis, angulis apicalibus in spinam binam sursum directam praeditis; a latere visae ovato-circulares, polis cum duabus spinis brevibus infra spinam apicis. Long. sine spin.  $32\mu$ , cum spin.  $58.8\mu$ , Lat. sine spin.  $30.7\mu$ , cum spin.  $61.6\mu$ , Lat. isth.  $11.3\mu$ , Crass.  $16.8\mu$ , Long. spin.  $12.6\mu$ .

Hab. **Hondo**: Ozegahara in Kôzuke. (Pl. XXIX, f. 8)

Distr. British Isles, Sweden, Finland.

**Arthrodesmus tenuissimus** ARCH. in RABENHORST Flor. Europ. Alg. III, 226, 1868; MIGULA Krypt. Fl. **2**, 512, 1907; WEST Monogr. Brit. Desm. **4**, 116, 1911; KAISER Krypt. Forsch. **1**, 227, 1919; DICK l. c. 451, 1926; HIRANO Journ. Jap. Bot. **20**, 49, 1944.

Cellulae minutae, leviter longiores quam latiores sine spinis, profunde constrictae, sinu aperto rectangulari; semicellulae hexagonales, marginibus superioribus et inferioribus fere rectis vel leviter concavis, angulis lateralibus rectangularibus cum spinis minutis horizontaliter directos ordinatis, apicibus truncatis rectis vel leviter concavis, angulis apicalibus cum spinis minutis ordinatis, spinis subrectis et vix visibilibus in vertice; a vertice visae elliptico-fusiformes, polis leviter acutis cum spinis minutis ordinatis, spina minuta ad unumquemque polum; a latere visae circulares, cum spina minuta ad angulum superiorem, spinis divergentibus. Long.  $9\mu$ , Lat.  $7.8\mu$ , Lat. isth.  $5.6\mu$ .

Hab. **Hondo**: Shigakôgen in Shinano. **Kiushiu**; Imuta-ike in Satsuma. (Pl. XXIX, f. 10)

Distr. Japan, India, Europe.

**Arthrodesmus trispinatus** W. & G. S. WEST var. **japonicum** HIRANO, var. nov.

Var. semicellulae subhexagonales, marginibus lateralibus inferioribus longioribus quam superioribus, apice et margine laterali recto; spinis divergentibus, spinis inferioribus in parte ordinatis. Long. sine spin.  $11.2\mu$ ,

Lat. sine spin.  $10.5\mu$ , Lat. isth.  $7\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Hijiori-ônuma in Uzen.  
(Pl. XXIX, f. 9)

### **Xanthidium** EHRENB.

in RALFS Brit. Desm. 111, 1848; RABENHORST Flor. Europ. Alg. III, 221, 1868; WEST Monogr. Brit. Desm. 4, 48, 1911; SMITH Wisc. Bull. 57, 55, 1924; WEST & FRITSCH Treat. Brit. Alg. 279, 1927; PRINTZ in ENGL. Pflanzenfam. 3, 356, 1927; SMITH Freshw. Alg. U. S. 582, 1933.

Cellulae variabiles, generalis paullo longae quam latae, profunde constrictae, sinu lineari vel aperto acutangulo; semicellulae paene generalis compressae et variabiles, ellipticae, elliptico-hexagonales, trapeziformes vel polygonales, apicibus rectis, in centro semicellularum partibus protuberantiis incrassatis et ibi saepe scrobiculatis praeditis; membrana glabra vel punctata et spinis simplicibus vel raro furcatis ad angulos praeditis, aliquando symmetrice ad margines medianis utrobique praeditis; a vertice visae ellipticae, lateribus ad medium utrobique paullo protuberantiis praeditis; chromatophoris axialibus duabus vel parietalibus quaternis in unaquaque semicellula praeditis; zygosporae globosae, membrana scrobiculata, spinis simplicibus vel furcatis in longitudine variabile praedita.

- 1a. Cellulae parvae vel modicae, cum spinis longis simplicibus ordinatae  
..... Sect. **Holacanthum**
- 1b. Cellulae parvae vel minutae, cum spinis minutis simplicibus ordinatae  
..... Sect. **Micracanthum**
- 1c. Cellulae magnae, cum processibus in apices 2-4 furcatis ordinatae  
..... Sect. **Schizacanthum**

### **Sect. Holacanthum** LUND.

*Xanthidium* subgen. *Holacanthum* LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 75, 1871—  
sect. *Holacanthum* in WEST Monogr. Brit. Desm. 4, 50, 1911.

Cellulae modicae vel parvae, lateribus utrobique cum spinis longis simplicibus ordinatis, spinis duabus vel singulis ad angulos; chromatophoris parietalibus 4 in unaquaque semicellula.

- 1a. Semicellulae cum spinis singulis tantum ordinatae.
- 2a. Angulo apicali non producto.
  - 3a. Semicellulae obtrapeziformes, cum spinis singulis ad marginem prope  
angulos apicales utrobique ..... **X. inchoatum**
  - 3b. Semicellulae rotundo-subtrapeziformes vel depresso-ovatae.
  - 4a. Semicellulae cum spinis singulis ad medium marginem lateralem utrobique  
..... **X. apiculatum**
  - 4b. Semicellulae cum spinis tribus paullo irregulariter ad marginem lateralem  
utrobique. .... **X. pseudobengalicum**
  - 3c. Semicellulae oblongo-reniformes cum spinis tribus ad marginem lateralem  
utrobique ..... **X. bengalicum**

- 2b. Angulo apicali producto, angulis cum spinis duabus longis ordinatis ..... **X. japonicum**
- 1b. Semicellulae cum spinis singulis et partim ordinatae.
  - 2a. Semicellulae cum spinis partim et spinis duabus (non partim) ad marginem lateralem utrobique ordinatae.
    - 3a. Angulo apicali non producto, spinis lateralibus evidenter dispositis.
      - 4a. Spina recta ..... **X. hastiferum** var. **javanicum**
      - 4b. Spina curvata ..... **X. hastiferum** var. **curvispinosum**
    - 3b. Angulo apicali producto, spinis lateralibus aliquantum propinquis dispositis ..... **X. angulatum**
  - 2b. Semicellulae cum spinis partim duabus et spinis singulis ad marginem lateralem utrobique ordinatae ..... **X. cristatum**
  - 3a. Semicellulae subpyramidatae, cum tumore granulato mediano ordinatae ..... var. **uncinatum**
  - 3b. Semicellulae oblongae, cum tumore glabro mediano ordinatae ..... var. **uncinatum** f. **depressa**
  - 3c. Semicellulae semicirculari-subtrapeziformes, sine tumore mediano; membrana glabra ..... var. **leiodermum**
- 1c. Semicellulae cum spinis partim tantum ordinatae.
  - 2a. Semicellulae cum spinis partim duabus ad marginem lateralem utrobique ordinatae.
    - 3a. Angulo non producto; semicellulae exacte hexagonae, cum serie radiali scrobiculorum ad medium, aliquando nullae ..... **X. antilopaeum**
    - 4a. Cellulae 42-72 $\mu$  in longitudinem sine spinis, cum loco scrobiculato mediano ordinatae ..... f. **typica**
    - 4b. Cellulae 80-90 $\mu$  in longitudinem sine spinis, cum loco glabro mediano ordinatae ..... var. **laeve**
  - 3b. Angulo producto; semicellulae subhexagonae cum serie transversali scrobiculorum supra isthmum ordinatae ..... **X. Burkillii**
- 2b. Semicellulae cum spinis partim tribus ordinatae ..... **X. fasciculatum**
- 2c. Semicellulae cum spinis partim numerosis ordinatae ..... **X. acanthophorum**

**Xanthidium inchoatum** NORDST. in K. Sv. Vet. Akad. Handl. 22, 45, 1888.

Cellulae mediocres, circiter tam longae quam latae vel leviter longiores sine spinis, profunde constrictae, sinu angusto-lineari in apice leviter dilatato; semicellulae subobtrapeziformes vel leviter oblongo-hexagonales, angulis basalibus obtusis, marginibus lateralibus convexis et leviter divergentibus, angulis apicalibus rotundis cum spinis longis robustis divergentibus, apicibus semicellularum leviter convexis; a latere visae late obovatae, apicibus spinis praeditis; a vertice visae ellipticae, polis spinis praeditis; membrana incrassata in medio semicellularum. Long. sine spin. 36.4 $\mu$ , Lat. sine spin. 33.6 $\mu$ , Lat. isth. 8.4 $\mu$ .

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Asia) (Pl. XXX, f. 18)  
Distr. Finland, New Zealand.

**Xanthidium apiculatum** (JOSHUA) HIRANO, comb. nov.

*Arthodesmus apiculatus* Joshua in Journ. Linn. Soc. Bot. 21, 644, 1886.

Cellulae modicae, circiter 1 $\frac{1}{2}$  longiores quam latiores, profunde constrictae,

sinu angusto-lineari extremo ampliato; semicellulae rotundo-subtrapeziformes vel depresso-ovatae, angulis basalibus late rotundis, marginibus lateralibus superioribus retusis cum spinis brevibus robustis suberectis supra angulos laterales ordinatis et in versus sursum directis, apice recto vel leviter convexo cum angulis apicalibus obtusis vel rotundis ordinato; a latere visae circulares spinis brevibus infra apicem ordinatae; membrana in margine laterali utrobique evidenter incrassata; a vertice visae rhomboido-oblongae, polis rotundis. Long. sine spin.  $42\mu$ , Lat. sine spin.  $34\mu$ , Lat. isth.  $8.5\mu$ .

Hab. **Hondo**: Ishigaki-ike in Ise. (New to Japan) (Pl. XXX, f. 16, 17)  
Distr. Burma.

**Xanthidium pseudobengalicum** GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. **49**, 50, 1921.

Cellulae mediocres, paullo longiores quam latiores sine spinis, profunde constrictae, sinu aperto acuminato ad apicem; semicellulae subelliptico-trapeziformes, marginibus inferioribus convexis, spinis longis tribus et paullo curvatis ad sursum uterque ordinatis, spinis non ordinatis in plana eadem; membrana glabra sine porosa vel scrobiculata; a latere visae paene circulares, lateribus paullo incrassatis in medio utrobique, spinis irregulariter ordinatis non in plana verticali. Long. sine spin.  $47.3\mu$ , cum spin.  $64.5\mu$ , Lat. sine spin.  $41\mu$ , cum spin.  $60.2\mu$ , Lat. isth.  $11.6\mu$ .

Hab. **Hokkaido**: Kamikoshi-ukishimahara in Ishikari. (New to Japan)  
(Pl. XXX, f. 3)

Distr.

**Xanthidium bengalicum** TURNER in K. Sv. Vet. Akad. Handl. **25**, 100, 1893; WEST Trans. Linn. Soc. Bot. **6**, 161, 1902; OKADA Bot. Mag. **50**, 256, 1936.

Cellulae mediocres, circiter latiores quam longiores sine spinis, profunde constrictae, sinu aperto acutangulo ad apicem, isthmo leviter elongato; semicellulae subfusiformi-reniformes vel oblongo-reniformes, marginibus lateralibus inferioribus convexis, marginibus superioribus leviter retusis, apicibus rectis vel convexis, angulis apicalibus et lateralibus spina una longa parum alte curvata; membrana punctata; a latere visae circulares; a vertice visae oblongo-ellipticae. Long. sine spin.  $47.6\mu$ , cum spin.  $64.4\mu$ , Lat. sine spin.  $50.4\mu$ , cum spin.  $81.2\mu$ , Lat. isth.  $14\mu$ , Long. spin.  $11\mu$ .

Hab. **Hondo**: Kanori-ike in Shinano, Ogurano-ike in Yamashiro (OKADA)  
(Pl. XXX, f. 4)

Distr. Japan, India, Ceylon.

**Xanthidium japonicum** HIRANO in Act. Phytotax. Geobot. **14**, 1, 1949.

Cellulae mediocres, leviter latiores quam longiores sine spinis, profunde constrictae, sinu angusto-lineari; semicellulae obtrapeziformes, angulis basalibus obtusis, marginibus lateralibus convexis, angulis apicalibus productis et in oblique alte projectis et spinis duabus longis robustis in plana verticali ordinatis, apice convexo; membrana glabra; chromatophoris axialibus cum pyrenoidibus centralibus in unaquaque semicellula; in vertice et latere visae non observatae. Long. sine spin.  $32-34\mu$ , Lat. sine spin.  $35-37\mu$ , Lat. isth.  $11\mu$ , Long. spin.  $13\mu$ .

Hab. **Hondo**: Shinohara-ike in Oomi. (Pl. XXX, f. 20)

Distr. Japan.

**Xanthidium hastiferum** TURNER var. **javanicum** (NORST.) TURNER in K. Sv. Vet. Akad. Handl. **25**, 100, 1893; OKADA Bot. Mag. **50**, 255, 1936.—forma *plana* TURN. in l. c. 100, 1893; OKADA ASAHINA's Inkwa. 175, 1939.—*Xanthidium antilopaeum* (BRÉB.) KÜTZ. forma *javanica* NORDST. in Lund Univ. Arsskr. **16**, 12, 1880.

Var. spinis longioribus quam in forma typica, apice paene recto. Long. sine spin.  $41-42\mu$ , Lat. sine spin.  $38-39\mu$ , Lat. isth.  $10\mu$ , Long. spin. 20-23.

Hab. **Hondo**: Ôike on Mt. Hichimenzan in Kai; Toba in Ise; Shinohara-ike in Oomi. (Pl. XXX, f. 19)

Distr. Japan, Burma, India, Java.

var. **curvispinosum** OKADA in Bot. Mag. **50**, 255, 1936; ASAHINA's Inkwa. 175, 1939.

Cellulae maiores, apicibus semicellularum late truncatis et rectis, spinis curvatis. Long. sine spin.  $36-39\mu$ , Lat. sine spin.  $34-36\mu$ , Lat. isth.  $9-10\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Ôishita in Uzen; Akaiyachi in Iwashiro; Kotsutsumi-nishi-ike, Suhara-ike in Mikawa. (Pl. XXX, f. 2)

Distr. Japan.

**Xanthidium angulatum** (JOSHUA) HIRANO, stat. nov.

*Xanthidium antilopaeum* (BRÉB.) KÜTZ. var. *angulatum* JOSHUA in Journ. Linn. Soc. Bot. **21**, 643, 1886.

Cellulae modicae, circiter tam longae quam latae sine spinis, profunde constrictae, sinu acuminato vel angusto-lineari ad extremum; semicellulae subfusiformes vel subhexagonales, angulis lateralibus productis et aliquantum emarginatis spinis duabus longis robustis ordinatis, marginibus ventralibus longioribus quam dorsalibus, leviter convexis et recurvatis prope angulos laterales, apice elevato et truncato, angulis apicalibus obtusis parte spinarum ordinatis, spinis apicalibus brevioribus quam spinis lateralibus; a latere visae late ellipticae cum spinis apicalibus duabus et spinis aliis duabus infra apicem ordinatis; a vertice visae rhomboides, polis rotundis cum spinis longis et partim spinum intra polum ordinatis; membrana glabra.

Long. 36–37 $\mu$ , Lat. sine spin. 36–37 $\mu$ , cum spin. 78 $\mu$ , Lat. isth. 17 $\mu$ , Crass. 19–20 $\mu$ , Long. spin. 10–19 $\mu$ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Japan) (Pl. XXX, f. 9)

Distr. Burma.

**Xanthidium cristatum** BRÉB. var. **uncinatum** BRÉB. in RALFS Brit. Desm. 115, 1848; WEST Monogr. Brit. Desm. 4, 73, 1911; SMITH Wisc. Bull. 57, 60, 1924; HOMFELD Pflanzenf. 12, 64, 1929; TAYLOR Pap. Mich. Acad. Sci. 19, 275, 1934; OKADA Journ. Imp. Fish. Inst. 30, 176, 1934; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, 2, Pl. Crypt. 2, 88, 1934; PRESCOTT Pap. Mich. Acad. Sci. 25, 96, 1949.

Cellulae maiores, semicellulae late subpyramidatae cum apice truncato, marginibus lateralibus concavis inter angulos, spina apicalis et superior lateralis subrecta plerumque leviter incurvata, in centro semicellularum leviter incrassata cum annulo granulorum (circa 6) ornata. Long. sine spin. 43–80 $\mu$ , cum spin. 73–98 $\mu$ , Lat. sine spin. 43–53 $\mu$ , cum spin. 64–67 $\mu$ , Lat. isth. 13–14 $\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Nikuru-numa, Shimoyûbetsu in Kitami; Toyokoro-konuma in Tokachi; Moseushi, Horomui in Ishikari; Tomakomai, Numanohata in Iburi; Shizukari, Junsai-aka-numa, Ko-numa in Oshima. **Hondo**: Ogata in Ugo; Ôishita, Chûkawa-ike, Hakuryu-ko in Uzen; Ozegahara in Kôzuke; Inago of Kitamaki-mura, Happô-ridge, Ôhanami-ike, Lake Kizaki in Shinano; Tanuki-numa in Suruga; Fuse-ike, Nukigawa in Oomi; Ariga-ike, Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamada in Tosa. **Kiushiu**: Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXIX, f. 13, Pl. XXX, f. 15)

Distr. Japan, Kuriles, Manchuria, central China, N. India, Europe, N. America.

forma **depressa** HOMFELD in Pflanzenf. 12, 65, 1929; OKADA Inkwa. 175, 1939.

Forma depresso-elliptica, spinis lateralibus singulis robustis et majoribus quam spinis apicalibus partium superiorum; cellulis in vertice visis ellipticis, lateribus leviter incrassatis in medio utrobique. Long. sine spin. 39–42 $\mu$ , cum spin. 62 $\mu$ , Lat. sine spin. 39–42 $\mu$ , cum spin. 73 $\mu$ , Lat. isth. 11–14 $\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Tomakomai, Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Fuse-ike in Oomi. **Kiushiu**: Imuta-ike in Satsuma; Ahira in Ôsumi. (Pl. XXX, f. 7)

Distr. Japan, Germany.

var. **leiodermum** (ROY & BISS.) TURNER in K. Sv. Vet. Akad. Handl. 25, 99, 1893; WEST Monogr. Brit. Desm. 4, 72, 1911; OKADA Journ. Imp. Fish. Inst. 30, 176, 1934—*Xanthidium leiodermum* ROY & BISSET in Journ. Bot. 24, 268, 1886.

Semicellulae in vertice visae leviter incrassatae in medio utrobique (non tumidae); membrana glabra. Long. sine spin. 42–48 $\mu$ , Lat. sine spin. 34–



39 $\mu$ , Lat. isth. 11 $\mu$ , Long. spin. 7-8 $\mu$ .

**Hab. Hokkaido:** Kiritappu in Kushiro; Shikaribetsu-wopputo in Tokachi; Komukai-ponto in Kitami; Minenobu in Ishikari; Yûfutsu, Numanohata in Iburi. **Hondo:** Kesho-numa in Rikuzen; Akaiyachi in Iwashiro; Ozegahara in Kôzuke. (Pl. XXX, f. 22)

Distr. Japan, Kuriles, Siberia, India, Europe, U. S. A.

**Xanthidium antilopaeum** (BRÉB.) KÜTZ in Spec. Alg. 177, 1849; WOLLE Desm. U. S. 94, 1884; RCY & BISSET Journ. Bot. 24, 240, 1836; WEST Monogr. Brit. Desm. 4, 63, 1911; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 44, 1921; SMITH Wisc. Bull. 57, 57, 1924; OKADA Journ. Imp. Fish. Inst. 30, 174, 1934; TAYLOR Pap. Mich. Acad. Sci. 19, 275 1934; IRÉNEÉ-MARIE Nat. Canad. 76, 32, 1949.

Cellulae mediocres, circiter tam longae quam latae sine spinis, profunde constrictae, sinu angusto-lineari extremo leviter ampliato exterius aperto; semicellulae hexagonales, apicibus et marginibus lateralibus superioribus rectis, marginibus inferioribus leviter convexis, angulis apicalibus et lateralibus omnibus leviter rotundis cum spina longa robusta recta vel leviter incurvata ordinatis, in centro semicellularum membrana incrassata, scrobiculis multis ordinatis; a latere visae circulares, spinis longis duabus divergentibus ad angulum superiorem et spinis duabus similibus prope centrum infra spinam apicalem ordinatis; a vertice visae ellipticae, polis late rotundis cum spinis duabus longis leviter divergentibus ad polum et duabus spinis similiter intra polum ordinatis; membrana subtiliter punctata. Long. sine spin. 45-52 $\mu$ , Lat. sine spin. 43-51 $\mu$ , Lat. isth. 13-22 $\mu$ .

**Hab. Hokkaido:** Kiritappu in Kushiro; Komukai-ponto, Shimoyûbetsu, Sarufutsu in Kitami; Toyokoro, Shikaribetsu-wapputo in Tokachi; Horomui, Minenobu in Ishikari; Tôasa-numa, Numanohata, Benten-numa in Iburi; **Hondo:** Hachimantai in Rikuchû; Hirumo-numa in Ugo; Hakuryu-ko, Chûkawa-ike, Ôishita in Uzen; Kesho-numa, Naga-numa, Kobuchi-numa in Rikuzen; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Umaushi-numa in Iwaki; Oze in Kôzuke; Ushiku-numa, Gôno-ike in Hitachi; Inago of Kitamaki-mura, Ôhanami-ike, Kizaki in Shinano; Ôike of Mt. Hichimenzan in Kai; Tanuki-numa in Suruga; Takashihara in Mikawa; Ishigaki-ike, Jôdo-ike in Ise; Shinohara-ike, Fuse-ike, Nukigawa, Mt. Hira, Lake Biwa in Oomi; Mizoroga-ike in Yamashiro. **Shikoku:** Yamauchi-mura in Sanuki. **Kiushiu:** Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXIX, f. 12)

Distr. Japan, Kuriles, Siberia, Mongolia, Manchuria, Kamtschatka, N. India, whole Europe, N. & S. America.

var. **laeve** SCHMIDLE in WEST Monogr. Brit. Desm. 4, 68, 1911; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 46, 1921; KOSSINSKAJA Act. Inst. Pot. Acad. Sci. URSS, 2, Pl. Crypt. 2, 87, 1934.

Cellulae plerumque maiores, semicellulae sine scrobiculato-protuberantibus vel non incrassatae; membrana fine punctata. Long. sine spin.  $59-70\mu$ , Lat. sine spin.  $56-59\mu$ , Lat. isth.  $17-20\mu$ , Long. spin.  $19-22\mu$ .

Hab. **Hokkaido**: Nikuru-numa in Kitami. **Hondo**: Koke-numa in Ugo; Ozegahara in Kôzuke; Shirouma-ôike in Shinano. (Pl. XXX, f. 1)

Distr. Siberia, Europe.

**Xanthidium Burkillii** W. & G. S. WEST in Ann. Roy. Bot. Gard. Calcutta 6, 210, 1907.

Cellulae mediocres, leviter latiores quam longiores sine spinis, profunde constrictae, sinu angusto-lineari extremo dilatato; semicellulae subhexagonales, marginibus lateralibus inferioribus tumidis et leviter longioribus quam lateralibus superioribus, angulis basalibus rotundis, angulis apicalibus et lateralibus productis mamillatis et spinis longis singulis robustis ordinatis, semicellulae cum serie transversali scrobiculorum ad medium et scrobiculis magnis singulis medianis ordinatis; a vertice visae subellipticae, polis bimamillatis cum spinis divergentibus ad extremum utrobique ordinatis. Long. sine spin.  $42\mu$ , cum spin.  $70\mu$ , Lat. sine spin.  $53\mu$ , cum spin.  $76\mu$ , Lat. isth.  $11\mu$ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Toyokoro in Tokachi. (New to Japan) (Pl. XXX, f. 5)

Distr. Burma, India.

**Xanthidium fasciculatum** EHRENB. in ROY & BISSET Journ. Bot. 24, 240, 1886; WEST Monogr. Brit. Desm. 4, 75, 1911; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 52, 1921; HOMFELD Pflanzenf. 12, 65, 1929; ALLORGE Rev. Alg. 5, 362, 1930—var. *polygonum* RALFS in Brit. Desm. 114, 1848.

Cellulae modicae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari ad apicem et exterius aperto; semicellulae angulari-reniformes, marginibus lateralibus cum spinis equidistantibus 6 ordinatis, spinis longis robustis rectis, apicibus paene rectis, partibus medianis semicellularum leviter incrassatis et glabris; a latere visae subcirculares, lateribus paullo protuberantibus in medio utrobique, seriebus distantibus 3 spinarum verticaliter ordinatis et spinis divergentibus; a vertice visae ellipticae, polis cum spinis divergentibus. Long. sine spin.  $67\mu$ , cum spin.  $92\mu$ , Lat. sine spin.  $53\mu$ , cum spin.  $76\mu$ , Lat. isth.  $17\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Yûfutsu, Tôasa-numa in Iburi. **Hondo**: Koke-numa in Ugo; Hakuryu-ko in Uzen; Izu-numa in Rikuzen; Fuse-ike in Oomi. (Pl. XXX, f. 6)

Distr. Japan, Manchuria, N. India, whole Europe, Greenland, U. S. A., Brazil.

**Xanthidium acanthophorum** NORDST. in Lund Univ. Årsskr. **16**, 11, 1889; WEST Trans. Linn. Soc. Bot. **6**, 158, 1902; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **47**, 51, 1920; OKADA Bot. Mag. **50**, 316, 1936.

Cellulae mediocres, fere circulares, leviter latiores quam longiores sine spinis, profunde constrictae, sinu angusto-lineari extremo leviter dilatato et exterius aequè aperto; semicellulae semicirculares, angulis basalibus bene rotundis, apicibus leviter inflatis, margine laterali et apicali seriarum duarum spinarum (circa 5) intra marginem praeditis; a vertice visae paullo rhomboido-oblongae, lateribus in medio utrobique incrassatis; a latere visae circulares, seriebus subparallelis distinctibus 2 spinarum verticaliter praeditis. Long. sine spin.  $43-45\mu$ , Lat. sine spin.  $36-38.7\mu$ , Lat. isth.  $13-14\mu$ , Long. spin.  $3\mu$ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Moritake-ôtsutsumi, Nishi-numa, Megata in Ugo; Ôishita in Uzen; Akaiyachi in Iwashiro; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Jôdo-ike in Ise; Fuse-ike in Oomi; Ko-ike, Ariga-ike in Yamashiro. (Pl. XXX, f. 21)

Distr. Japan, Java, Ceylon, Europe.

#### Sect. **Micracanthum** TURNER

*Xanthidium* subgen. *Micracanthum* TURNER in K. Sv. Vet. Akad. Handl. **25**, 103, 1893.—sect. *Micracanthum* in WEST Monogr. Brit. Desm. **4**, 51, 1911.

Cellulae minutae, spinis minutis ordinatis, spinis vix visibilibus duabus vel singulis.

- 1a. Semicellulae elliptico-hexagonae, spinis acutis, spinis lateralibus ad deorsum directis ..... **X. concinnum** var. **Boldtiana**
- 1b. Semicellulae transverse hexagonae, sinu late aperto rectangulari, spinis lateralibus horizontalibus ..... **X. concinnum** var. **ozense**
- 1c. Semicellulae transverse subhexagonae, dorso margini longiore quam ventre, spinis ad deorsum directis ..... **X. concinnum** var. **hexagonum**

**Xanthidium concinnum** ARCH. var. **Boldtiana** WEST in Journ. Linn. Soc. Bot. **29**, 167, 1892; JOHNSON Bull. Torrey Bot. Club **22**, 295, 1895; WEST Monogr. Brit. Desm. **4**, 87, 1911; DEFLANDRE Bull. Soc. Bot. France. **71**, 919, 1924.

Semicellulae elliptico-hexagonales cum apicibus leviter convexis, sinu acutangulo, spinis directis oblique deorsum; a vertice visae elliptico-octagonales. Long.  $8.4\mu$ , Lat. sine spin.  $7\mu$ , cum spin.  $10.6\mu$ , Lat. isth.  $4.2\mu$ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Azuma in Uzen; Mt. Naeba in Echigo; Mt. Tateyama in Etchû; Mt. Kirigamine, Daimon-pass, Happô-ridge, Tengunohara in Shinano. (Pl. XXX, f. 12-14)

Distr. Japan, Europe, U. S. A.

var. **ozense** HIRANO, var. nov.

Semicellulae hexagonales cum apicibus truncatis et leviter concavis (non convexis), sinu aperto rectangulari, spinis modice longis et horizontalibus. Long.  $8\mu$ , Lat. cum spin.  $11\mu$ , Lat. isth.  $4\mu$ .

Hab. **Hondo**: Oze in Kôzuke. (Pl. XXX, f. 10)

var. **hexagonum** (BOLDT) HIRANO, comb. nov.

*Arthrodesmus hexagonum* BOLDT in Ofvers K. Sv. Vet. Akad. Förh. 109, 1885; TEILING Sv. Bot. Tidsskr. 10, 65, 1916.

Semicellulae subhexagonae, marginibus lateralibus superioribus longioribus quam inferioribus, sinu acuto non acuminato, spinis deorsum directis. Long.  $6.2\mu$ , Lat. sine spin.  $6.2\mu$ , Lat. isth.  $2.8\mu$ .

Hab. **Hondo**: Izu numa in Rikuzen. (New to Asia) (Pl. XXX, f. 11)

Distr. N. Europe.

#### Sect. **Schizacanthum** LUND.

*Xanthidium* subgen. *Schizacanthum* LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 74, 1871.

—sect. *Schizacanthum* in WEST Monogr. Brit. Desm. 4, 50, 1911.

Cellulae magnae, lateribus utrobique cum processibus brevibus in apice 2-4 furcato ordinatis; chromatophoris parietalibus 4 in unaquaque semicellula.

Species unica ..... **X. armatum**

**Xanthidium armatum** (BRÉB.) RABENH. in Flor. Europ. Alg. III, 222, 1868; LUNDELL Nov. Act. Regn. Soc. Ups. 3, VIII, 75, 1871; WOLFE Desm. U. S. 92, 1884; WEST Monogr. Brit. Desm. 4, 51, 1911; KAWAMURA Freshw. Biol. 1, 101, 1918; SMITH Wisc. Bull. 57, 56, 1924; ALLORGE Rev. Alg. 5, 332, 1930; TAYLOR Pap. Mich. Acad. Sci. 19, 275, 1934; OKADA Journ. Imp. Fish. Inst. 30, 175, 1934; l. c. 33, 117, 1939.

Cellulae magnae, circiter  $1\frac{1}{3}$ — $1\frac{1}{2}$  longiores quam latae, profunde constrictae, sinu aperto acutangolo ad apicem leviter acuminato, interdum ampliato; semicellulae suboctangulares, apicibus rectis vel leviter convexis, marginibus lateralibus concavis, marginibus basalibus leviter convexis, angulis omnibus cum processibus brevibus robustis solidis (vel spinis verrucosis) ordinatis, apicibus processuum bis vel ter raro quater furcatis, et processibus similibus infra marginem lateralem et processibus bifurcatis subapicalibus in apice; in centro semicellularum est processus tuberculato-protuberans prominens, ad apicem cum annulo denticulorum marginalium simplicium vel emarginatorum; a latere visae ovato-rectangulares, lateribus cum tuberculato-processibus latis et solidis ad basim utrobique, seriebus furcato-processuum quaternorum apicalium et seriebus processuum similium transverse ordinatorum; a vertice visae elliptico-oblongae, polis subtruncatis

in margine processibus quaternis et processibus similibus quaternis intra marginem polorum ordinatis, lateribus cum tuberculato-processibus magnis truncatis et emarginatis in medio utrobique; membrana punctata. Long. sine proc.  $115-153\mu$ , Lat. sine proc.  $81-104\mu$ , Lat. isth.  $35-42\mu$ .

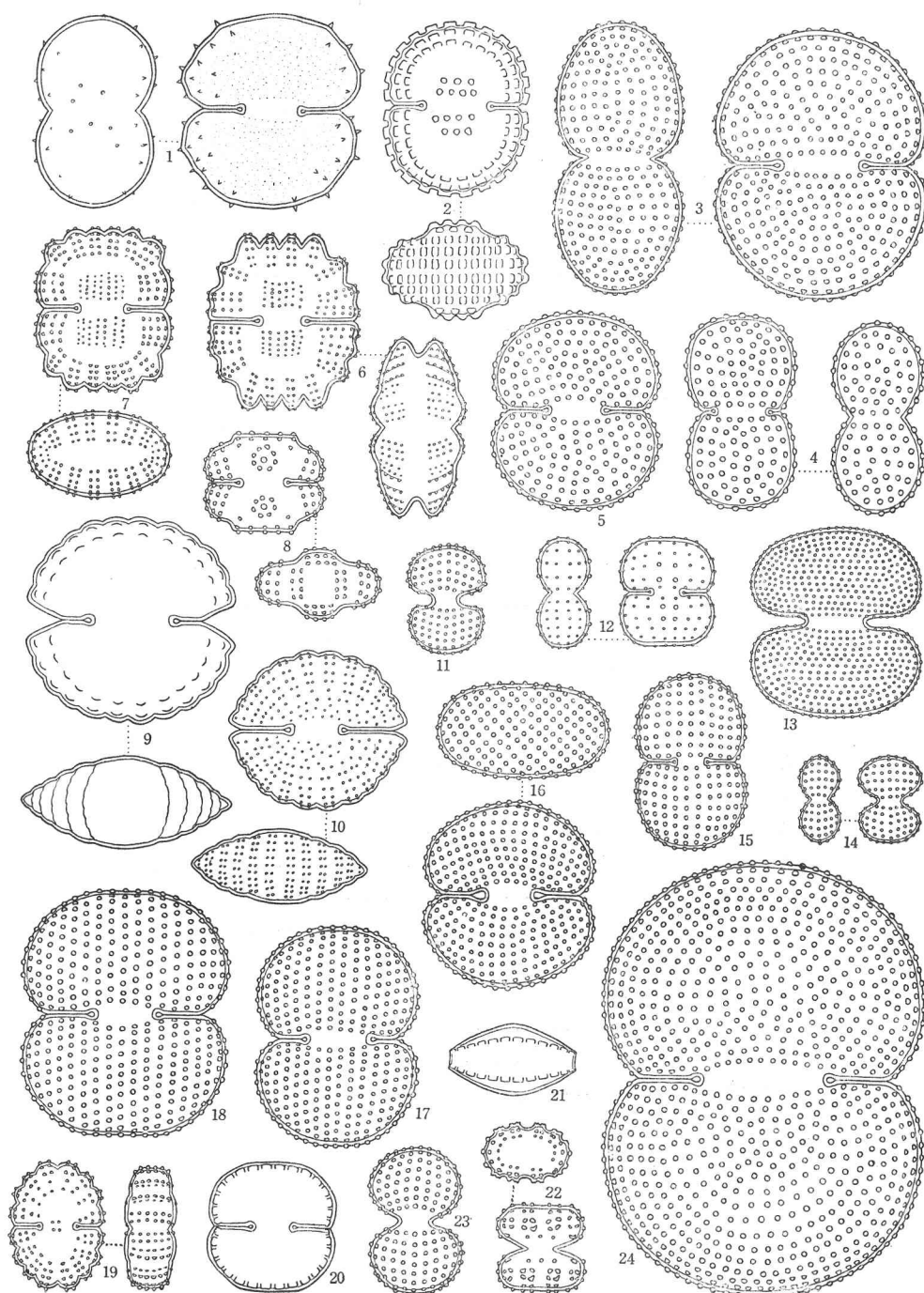
**Hab. Hokkaido:** Shikaribetsu-wopputo in Tokachi; Kamikoshi-ukishimahara, Mt. Daisetsu in Ishikari; Shizukari in Oshima. **Hondo:** Mt. Hakkoda in Mutsu; Hachimantai in Rikuchû; Mt. Kurikoma, Koke-numa in Ugo; Sugigamine of Mt. Zawo, Mt. Azuma in Uzen; Oze in Kôzuke; Takayachi on Mt. Myôko in Echigo; Mt. Tateyama in Etchû; Shigakôgen, Mt. Kirigamine, Happô-ridge, Kazafuki-kaminota, Tengunohara, Shirouma-ôike in Shinano; Takashihara in Mikawa; Mt. Hira, Oku-ike of Higashi-kusanomura in Oomi. (Pl. XXX, f. 8)

Distr. Japan, Kuriles, N. India, whole Europe, N. America.

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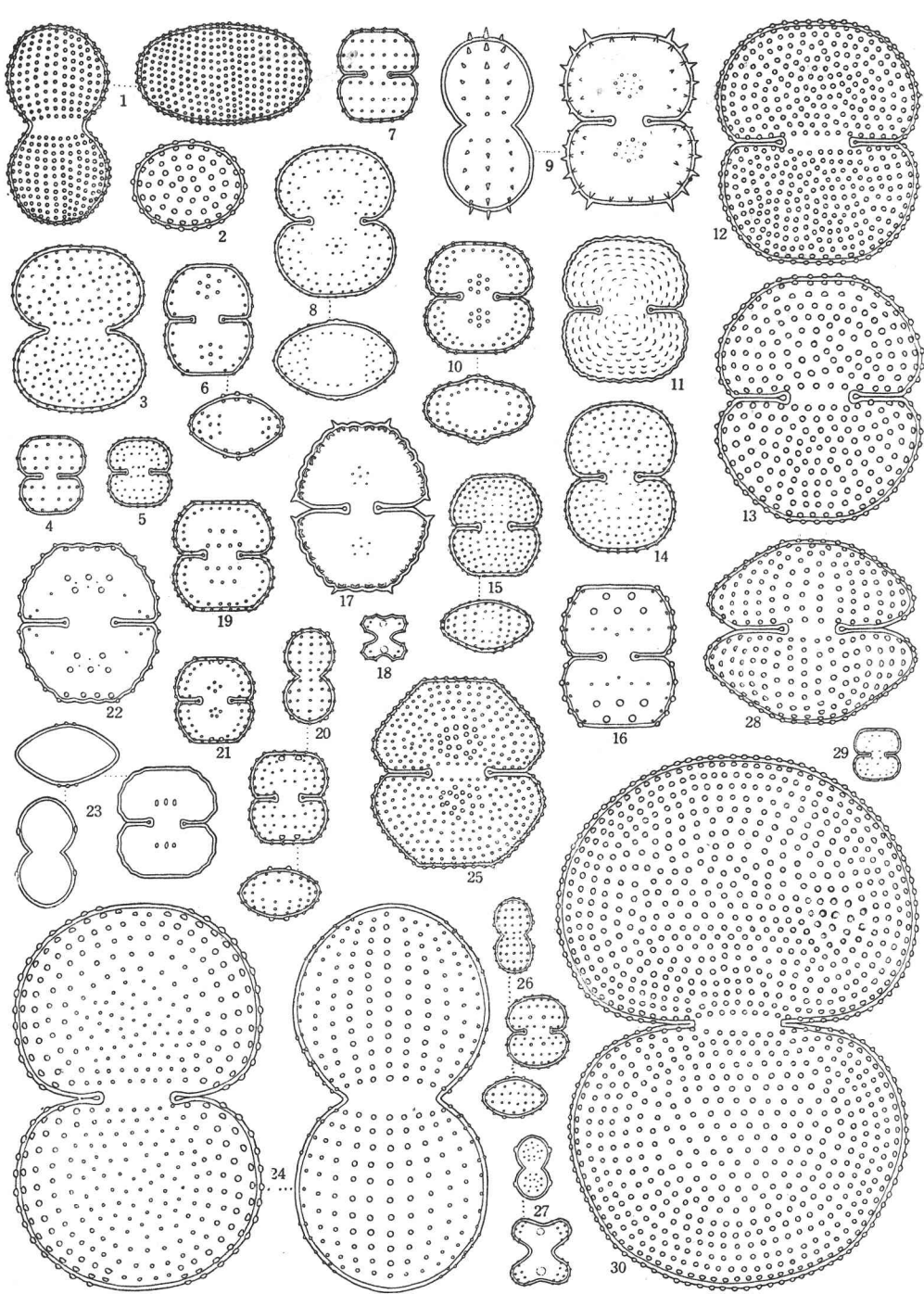
1—22. (×540)



## Plate XXVII.

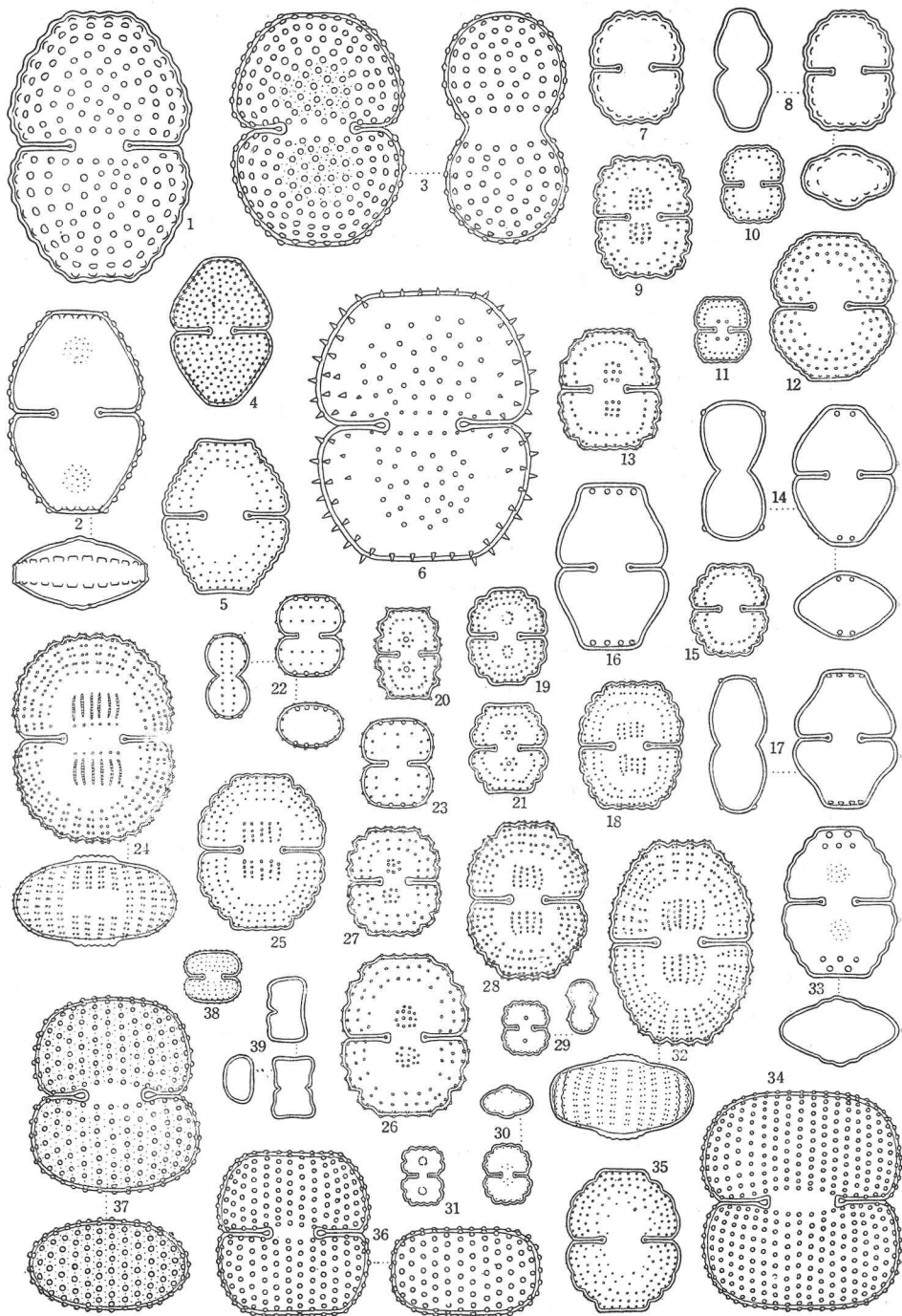
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30. <i>C. granulatum</i> WEST .....	176





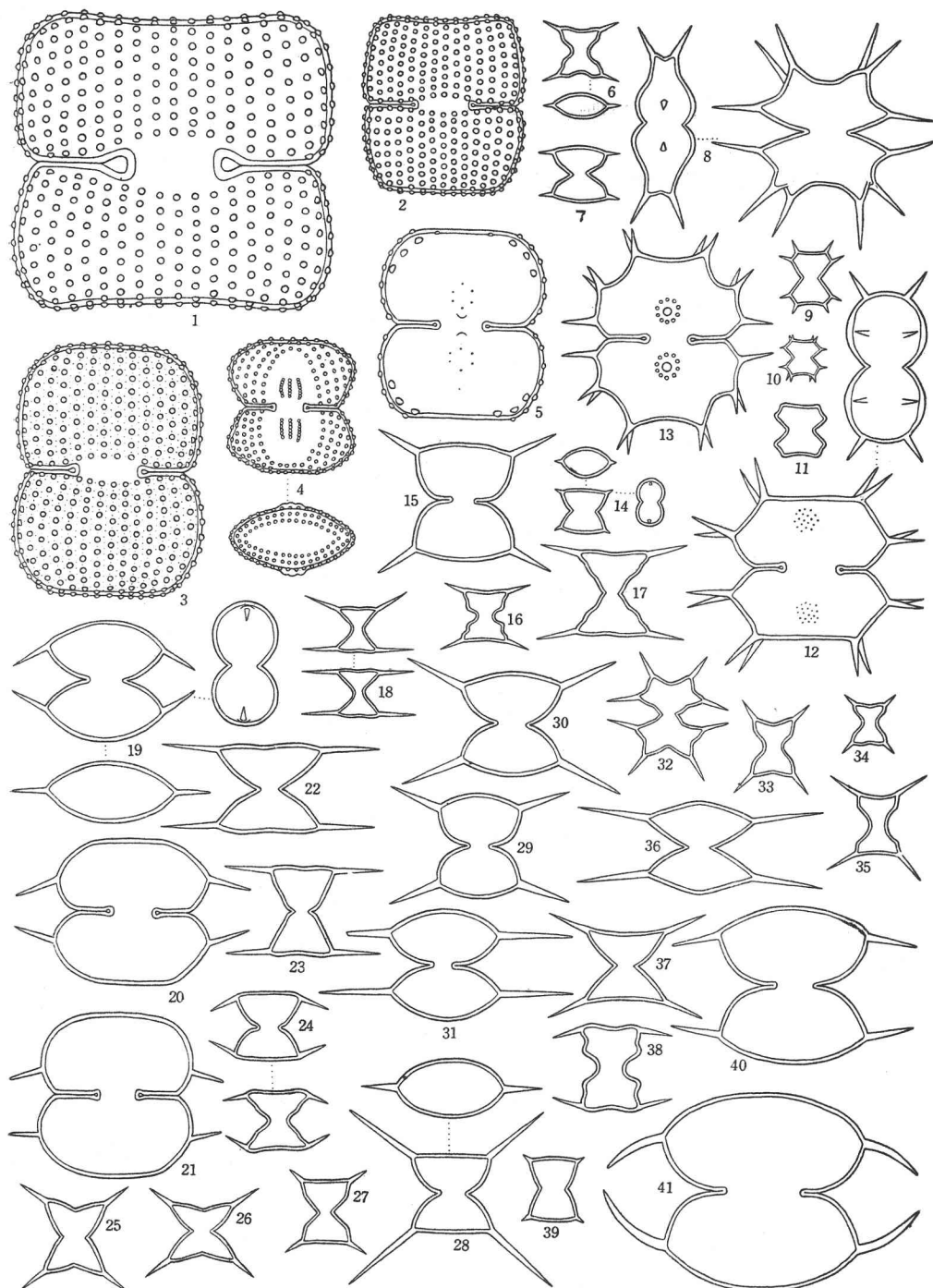
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1-22. (×500)

